The

Electrical Review

VOL. CVII. NOVEMBER 28, 1930. No. 2766.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY Price 6d.

Chairman and Joint Managing Director: G. H. ALABASTER, COMPANION I.E.E.

Technical Editor: C. O. BRETTELLE, M.I.E.E.

Joint Managing Director: E. A. GATEHOUSE, M.I.E.E., A.M.INST.C.E.

Commercial Editor: A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address: "AGEEKAY, CENT, LONDON." Code, A B C. Telephone No.: Central 5871 (5 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

Contents:

	PAGE
What of the Future?	893
The Italian State Railways	894
Tendencies in Illumination	894
The Trolley-'bus	894
The Growth of the Industry	895
The Chinese Market	895
Fixed Charges and Peak Loads	895
The Coming Generation	895
Barking Power Station *(illus.)*	896
Illuminating Engineering, by J. W. T. Walsh *(illus.)*	899
Electricity and the Gramophone, by S. F. Philpott *(illus.)*	901
High-voltage Measurement, by J. Plummer *(illus.)*	902
Electricity for the Home, by N. A. Chesterfield	904
Business and Industrial Notes	906
Lighting and Power Notes	911
Tramway and Railway Notes	912
Telegraph and Telephone Notes	913
Radio Notes	913
Contract Information	914
Forthcoming Events	915
Notes	916
Institution Notes	918
Our Personal Column	919
Financial Section—	
New Companies Registered	920
Official Returns of Electrical Companies	920
City Notes	921
Financial Section—*contd.*	
Stocks and Shares	921
The B.E.A.M.A. Dinner	923
Contractors' Supplies for China	924
Electricity and the Public Mind	925
Indian Electrical Notes	926
Reducing Accidents in Industry	926
Railway Electrification in Italy, by G. Bianchi	927
Electric Welding, by C. A. Hadley	929
Luminous Electric Tubes	929
Chromium Plating	930
New Electrical Devices, Fittings, and Plant *(illus.)*	931
Legal	932
Correspondence—	
Overheating of a Flywheel Motor	933
Prospects Overseas for Young Engineers	933
The Two-part Tariff	933
The E.D.A. Directorship	934
Public Lighting	934
Rural Electrification	934
Tariffs for Consulting Rooms	934
Lt.-Col. Vignoles's Tour: What a Canadian Thinks	934
British Motor Prices	934
The Coming Generation	935
Published Specifications	935
Trade Mark Applications	935
New Work for Contractors	936

What of the Future?

WHAT was once known as "political economy" is now styled simply "economics," and there is more in this change of title than a desire for brevity. It is an expression of the realisation that world affairs are not the preserve of politicians, but must receive the attention of all thinking men, particularly those practical-minded people who are loosely called "industrialists."

So far as the British electrical industry is concerned, one of the leading exponents of the new order is SIR HUGO HIRST, Bt., whose speech at last week's dinner of the B.E.A.M.A. contained much which will have to be considered by those who have the direction of national and Imperial affairs. The speech fell into three separate, but related, parts. In the first section Sir Hugo renewed a prophecy which he made just after the war regarding the predominant part which the electrical industry was to play in the regeneration of the country. That prophecy is quickly coming nearer to realisation, for electrification has become synonymous with progress. From whatever source it may be derived in the future, electrical energy will become increasingly the world's principal power agent; there is accordingly, so far as we can see, no limit to the expansion of the electrical industries.

In this country we are taking steps to prepare for future development, and, indeed, hastening that development, by large-scale co-ordination of generation and distribution. The Central Electricity Board, as befits a national institution, is ordering from British manufacturers all the plant necessary for bringing this reorganisation into effect. Its work is creating a great potential market for the thousand-and-one electricity-consuming appliances—again for the British manufacturer, one would think. But an increasing proportion of that business is going to foreign producers, as our electrical import statistics amply prove.

Can British manufacturers be blamed, therefore, if they assert that a market created by national means should be conserved for the nation? This was the culmination of the second part of Sir Hugo's speech, which carried in it a guarantee that the safeguarding of the electrical industry would mean lower, not higher, prices to the consumers of its products.

In the third part the speaker got on to a far more difficult subject. The problem, as he stated it, was: "How are we to reconcile our interests as an established industrial country, containing a large and intractable mass of unemployed, with the ambition of our Dominions to create their own centres of production instead of buying from us?" He contended that these apparently conflicting aspirations were capable of reconciliation and, indeed, in certain directions the problem had been solved. Australia, with whose conditions Sir Hugo has particularly familiarised himself, has a population of 6½ millions. This represents a demand sufficient to justify the home production of certain lines, but the manufacture in Australia of larger plant needed in smaller quantities would be uneconomical. This leaves a market for the exporting countries, and by means of tariff preferences, for which reciprocal concessions would be made, British manufacturers would be placed in a favourable position. Sir Hugo's plan appears to be as follows. British brains and capital should aid the Dominions to build up such manufacturing industries as they can economically maintain. This would naturally lead to smaller imports, and to that extent British trade would suffer if compensation were not forthcoming. But, instead of leaving the remainder of the import trade to be shared among the competing countries, the Dominions would impose tariffs with a sufficient preference to British manufacturers virtually to exclude all competitors. Thus our manufacturers would have an assured and remunerative market instead of being compelled to reduce their prices to extremely low levels to meet the competition of countries with lower standards than ours.

If inter-Imperial trade is to be maintained under the new order of things it is essential that there should be consultation between industrialists here and in the Dominions. Then, having settled a policy, they would ask their respective Governments to give their active assistance. The best part of a year must elapse before these grave matters can be considered by the Imperial Economic Conference. This should afford time for consultations between Empire industrial leaders, as suggested by Sir Hugo Hirst, so that something tangible can be formulated for presentation at the Conference.

The Italian State Railways.

The paper read before the Institution of Electrical Engineers by Commendatore G. Bianchi last week, based as it was on many years of practical experience, gave encouragement to those who hope to see some measure of main-line electrification in Great Britain in the not too distant future.

The author showed that if the cost of coal is high and the traffic dense, electrification would be economical. In this country the cost of coal, it is true, is much less than in Italy, but the traffic is twice as dense. The cost of electrical energy derived from water power is low, but it is generally believed that the report of Lord Weir's Committee, which we trust will soon be made public, will show that the cost of coal-produced electricity obtained from the grid will be quite comparable with that charged to railways by undertakings depending on water-power.

It is interesting to note that, as a result of experience with both 3-phase and d.c. operation, the latter system is to be employed for all new schemes on the grounds of its greater simplicity and ease of speed regulation. This decision supports the findings of the Kennedy Committee (1920) and of the Ministry of Transport Railway Electrification Committee (1927). The standards laid down by the latter were, it will be remembered, 1,500 volts d.c. overhead system, with the option of 3,000 volts subject to the consent of the Ministry, and 750 volts for third-rail systems.

In view of possible developments over here, Commendatore Bianchi's paper is timely, and we suggest that those interested in Italian railway developments might refer back to our issues of March 23rd and April 6th, 1928, wherein the review given by Major Theodore Rich of the Italian position may be regarded as in some respects supplementary to the paper under discussion.

Tendencies in Illumination.

The strides which have lately been made in illuminating engineering in all its branches, and by no means least on the electrical side, are truly remarkable. It is not long since nearly all the illuminating engineer's efforts were directed to the provision of adequate illumination for carrying on work after dusk or on gloomy days, and the use of light for other than strictly utilitarian purposes was comparatively rare. The remarkable change which has taken place during the last two or three decades is scarcely to be wondered at when the really extraordinary advances in the efficiency of modern illuminants are considered. The cost of artificial light to-day is less than one-sixth of what it was 25 years ago. Those were the days of the carbon-filament lamp, which gave about 3 to 4 lumens per watt of energy consumed (the arc lamp was, of course, quite unsuited for domestic lighting and, indeed, for many classes of industrial lighting). Now we have the gasfilled lamp which, even in the smaller sizes suitable for domestic use, yields about 10 to 12 lumens per watt.

The development of interest in illumination, reflected in advances such as those described in the article by Dr. J. W. T. Walsh appearing in this issue, has naturally led to a demand for some measure of standardisation in illuminating engineering equipment. Electric lamps have, of course, been manufactured to a B.E.S.A. specification for many years. This has been recently supplemented by the addition of schedules applying to such special types of lamps as those used for traction, train-lighting, and omnibus lighting. The specification for street-lighting has been very widely used, and there are now B.E.S.A. specifications for an important form of enamel reflector much used in factories and workshops, and for translucent glassware fittings for indoor lighting. A very useful part of the latter specification (also issued separately) is the section dealing with the neck and flange dimensions of illuminating glassware and the ring carriers used to support it.

Although the progress made during the last decade has been so marked, there is no sign of any flagging in the interest aroused. The Lighting Service Bureau of the Electric Lamp Manufacturers' Association at Savoy Hill is constantly engaged in demonstrating the latest advances in equipment and design, the meetings of the Illuminating Engineering Society attract an ever increasing audience, and the last report of the Council foreshadowed the formation, almost immediately, of one or more local centres of the Society.

Finally, the assembly of the International Congress on Illumination in this country next year, for which preparations on a very large scale are now being made, will certainly have a marked effect on the progress of the subject both here and abroad. The results of such an opportunity for the exchange of ideas among the hundreds of illuminating engineers gathered from every quarter of the globe cannot be estimated; that they will be far-reaching cannot be doubted, and it is a safe prediction that 1931 will mark an epoch in the history of illuminating engineering.

The Trolley-'bus.

A walk through the streets of one of our smaller towns where petrol 'buses have superseded tramcars often produces the honest, if rueful, conclusion that traffic conditions have been improved by the change. We think, however, that those towns which have sought the solution of the electric trolley-'bus have generally on all counts made the wiser choice. The points wherein they show superiority over the petrol vehicle have been stated on occasion in these columns. In his address as chairman of the North-Western Centre of the I.E.E. (an abstract of which appeared in our issue of November 7th) Mr. A. L. Lunn adds some other relevant

particulars. Perhaps the most striking of these is that a fleet of 50 trolley-'buses would keep 45 miners in constant employment, in addition to the men engaged in transporting the coal, whereas petrol is almost entirely of foreign origin. Furthermore, the cost of electricity used by a trolley-'bus is only about two-thirds that of the petrol and oil required for the other; operation costs are 20 per cent. less; maintenance is lower; and the financial life is ten years, compared with six for the petrol vehicle. In addition, there is the effect of the loss of the traction load on generation costs to be considered; this is bound to be reflected in the charges to other industrial users at a time when they need all the assistance and consideration they can get from supply undertakings.

The Growth of the Industry.

It goes without saying that the expansion of the consumption of electricity in this country during the past few years must have resulted in a large augmentation of the number employed in the various branches of the electrical industry. The actual figures, however, as published in the *Ministry of Labour Gazette*, are really surprising. These figures cover the period from July, 1923, to July this year and, although subject to slight modification on account of administrative changes during that time, can be taken to reflect the position fairly accurately. They show that during the seven years, although employment in general engineering, &c., declined to 92.3 per cent. of the 1923 figures, the number of insured persons in electrical engineering rose by 50.3 per cent. Similarly, the electric cable, wire, and lamp manufacturing industries recorded an advance of 43.7 per cent., and the electrical wiring and contracting industry one of 60.9 per cent.

At the same time the principal exporting industries of the country have either shown considerable less progress, or, as in the case of coal-mining, an actual decline. This affords support to Sir Hugo Hirst's prophecy at the B.E.A.M.A. dinner last week that before another generation passes the electrical manufacturing industry will play a dominant part in this country's production and export trade.

The Chinese Market.

As we have pointed out before, one of the paradoxes of current world trade is that China, though harassed by internal dissensions, is still carrying on an increasing import trade. In view of the country's state British traders are wise to proceed very warily, but judging by the Department of Overseas Trade report, which we review in this issue, there is a danger of excessive caution with a consequent loss of valuable business. In the matter of wiring materials and accessories we cannot hope to compete with the Germans and Japanese where the demand is for cheap and unsubstantial articles, and perhaps it is better for the good name of this country's products that we do not try to so compete. But there is also a call for materials of a better character in meeting which British manufacturers stand a chance of success.

An "expert" quoted in the report accuses British manufacturers of lack of energy in putting forward their goods, while competitors are striving for business. If this is true we can at least console ourselves with the fact that our electrical exports to China last year exceeded those of 1928. This trade has been kept at a fairly even level during the past few years and it may be that a little extra effort would raise it.

Fixed Charges and Peak Loads.

In his contribution to the "Electricity for the Home" section of this issue Mr. N. A. Chesterfield urges the Central Electricity Board and Joint Electricity Authorities to take a wide view when fixing kW charges, so as not to penalise progressive undertakers as the result of heavy heating-load peaks during short cold-weather snaps. Many bulk-supply undertakings were not encouraged in their efforts to push the domestic load by the results of the very cold spell in February, 1929.

We agree with Mr. Chesterfield up to a point. The kW charges, or, better still, the combination of kW and kWh charges, must not be such as to arrest development, but that hits both ways; a tendency to make the path too easy for the supply engineer in respect of normal peaks would also arrest development. The peak-load problem is still the main one for the supply man to solve, and is still peculiar to the electricity supply industry, and these hard facts must not be buried in the controversy around what might appear to be bigger questions of the moment. It must not be forgotten that the fixed costs form the greater part of the total cost of supply, and that there is only one real way of relieving this, namely, by improving the load factor.

All manner of schemes have from time to time cropped up for improving the load factor and increasing the useful service of the generating plant—from special tariffs and consumers' apparatus to district and national linking-up schemes—but so far the load curves show little improvement.

The success of any scheme for "filling up the valleys" then, the right and only road for full development, is bound up with the fixing of the kW charges to and by the supply engineer, who must always be penalised to some extent for the peaks.

The Coming Generation.

The proper reply to a suggestion that young engineers are not the equals of their predecessors is: "They never were." Written records of the past century indicate that the juniors of no period possessed the qualities that made their fathers what they were. Yet we seem to have made some progress on the whole. We recollect that the same kind of criticism was rife in 1914. An opportunity occurred then to prove it false, and the opportunity was taken.

A correspondent last week suggested that our young men of to-day were prone to avoid the hardships of the workshop. Our correspondent admitted one extenuating circumstance in the discouragement that comes through seeing positions filled by family influence rather than by merit. This we do not believe to be a material factor, for while nepotism no doubt still exists as one of the more amiable vices, it is probably less prevalent to-day than ever before. That, however, is a side issue, of small importance compared with the character of those who in a few years' time will form the personnel of our industry.

This week we are pleased to include in our "Correspondence" columns a spirited rejoinder, which indicates that our younger colleagues do appreciate that different times call for different methods.

Criticism of youth should not, however, be taken at its face value. It is often based upon the earnest hope of men who have been "through the mill" that there will be those coming after who can make full use of the opportunities created for them by past striving. It is the fear, rather than the belief, that this hope may be disappointed that causes such criticisms to be sometimes querulous in its tone. Moreover, this attitude of mind has the merit of preventing a complacent attitude towards progress, which is not and never will be automatic, and which will ultimately depend upon what those who are now students are able to do for themselves. Opportunities in the future—at present we are passing through a shadow that covers the world—will, we believe, be greater than they have been for the young electrical engineer, and by opportunities we mean not only those to be taken but also those to be made.

There may not be any longer quite the same scope for the individual of inventive genius that was provided in pioneering days, but the better-collated knowledge of our time, the shorter working hours (leaving more time for independent thinking) and the better prospects of making a reasonable living should enable the ordinary man to achieve more. These things are a heritage from the past that carry all the obligations of such a heritage and provide a scaffolding upon which the engineers of to-morrow may build something better than their elders with their more primitive implements were able to devise.

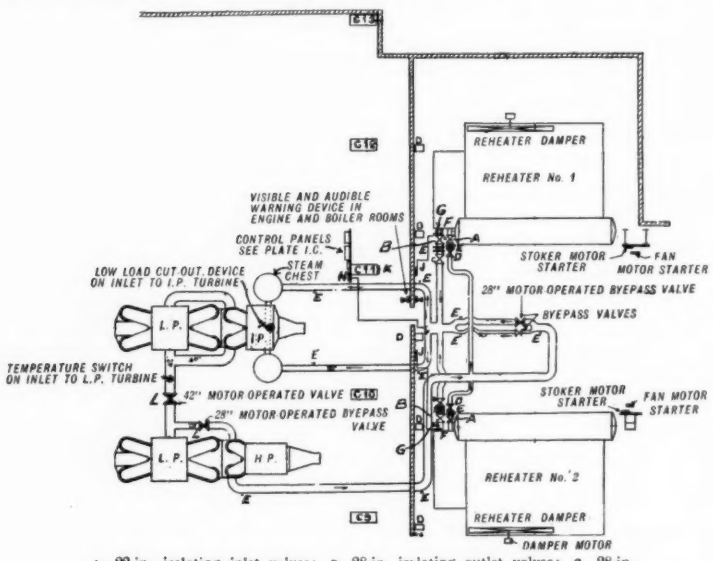
Barking Power Station.

A description of the plant at the latest generating station of the County of London Electric Supply Co., Ltd., which is now completed with an installed capacity of 240,000 kW.

(*Concluded from page* 854.)

The turbine-room plant, fig. 8, consists of four 40,000-kW m.c.r. turbo-alternators and four 20,000-kW sets. Parsons' reaction turbines driving Parsons' alternators, 3,000 r.p.m., 6,600 V, 50 cycles, are employed throughout. Each of the 40,000-kW turbines consists of h.p. and l.p. cylinders arranged in tandem on one shaft, and i.p. and l.p. cylinders in tandem on another shaft. The complete unit of four cylinders is arranged in two lines, side by side, each line driving a 20,000-kW alternator, the composite assembly thus forming a cross-compound turbine with two alternators. Each of the 20,000-kW turbines consists of h.p. and l.p. cylinders arranged in tandem on one shaft, driving a 20,000-kW alternator.

In view of the possible isolation of the station, and the fact that all auxiliaries are electrically driven, provision is made for starting two of the smaller sets without outside assistance, in the event of a total failure of supply. To meet this condition the l.p. cylinder can be isolated and exhausted by a single-stage air ejector discharging to atmosphere; the unit can then be run on the h.p. cylinder only, exhausting direct to atmosphere. Under these conditions an output of about 1,000 kW is available, which is sufficient for the auxiliaries of the necessary amount of boiler plant and one turbine. Each turbo-alternator forms a complete unit with its condensing, feed heating and auxiliary plant, the latter including boiler feed pumps and evaporators for the distillation of make-up feed water. The alternators, rotors, and exciters are interchangeable. Step-up transformers, 6.6/33 kV, are connected to the alternator stators without any intervening switchgear, all the main switches for the control of generation and station output being on the 33,000-volt side.



A, 22-in. isolating inlet valves; B, 28-in. isolating outlet valves; C, 28-in. outlet valves; D, 22-in. motor-operated inlet valves; E, drain connections; F, th-rmo-couples; G, "Arca" thermo relays; H & J, steam-temperature indicators; K, push buttons for controlling 28-in. by-pass valve; L, motor-operated valve.

Fig. 7.—Steam Reheater Connections.

The adjustment of the governor whip spring of each h.p. turbine can be effected by either the manually operated gear on the turbines, or by remote-control gear operated from the station control room. The i.p. line of each of the larger sets is provided with a governor and relay controlling a h.p. steam supply, thus enabling this half of the unit to run on load independently of the h.p. line. In the case of No. 1 turbine unit, 40,000 kW, which normally operates under reheat conditions in combination with the reheater boiler units, the i.p. line incorporates a further governing system. The reheated steam is returned to this line of the unit through two 28-in. valves, and the admission of steam through these valves is controlled by a governor and relays. The governor is permanently adjusted and locked, so as to hold the machine within, say, 5 per cent. above its normal running speed, thus

Fig. 8.—Looking Down the Turbine Room.

preventing the line being run up to tripping speed, by steam stored in the reheater system, in the event of the load being suddenly reduced. To guard against the failure of these valves closing under emergency conditions, vacuum breakers are provided; these automatically operate when the i.p. line trips, and thus, by destroying the vacuum, prevent the stored steam running the i.p. line up to a dangerous speed.

The alternator of each unit is cooled by a closed system of ventilation. The steam reheater arrangements are shown in fig. 7. With one reheater unit out of service and the turbine load greater than the other can deal with, part of the h.p. exhaust steam is directly by-passed to the i.p. cylinder. With both reheater units out of service the whole of the h.p. exhaust steam can be passed direct to the i.p. turbine, both reheater units being isolated by closing the necessary valves. Automatic temperature control of the reheated steam is effected by "Arca" temperature regulators, so designed that adjustments can be made to maintain an outlet steam temperature of any desired value between 650 deg. F. and 725 deg. F. Each "Arca" regulator actuates, through motor gear, the damper controlling the flue-gas outlet of the reheater section of each unit. The combination of turbo-alternator and reheaters is designed to operate under reheat conditions only between half load and full load on the turbine, since below half load the temperature drop in the i.p. cylinder is such that under reheat conditions the l.p. cylinders would be supplied with steam at a temperature higher than that for which they were designed. To guard against these conditions arising from emergencies in normal operation, such as sudden loss of load, a control is fitted on the i.p. cylinder inlet set to operate at a pressure corresponding to about half load on the machine. This control can be cut out of service for starting-up purposes. Further, to guard against excessive rise in reheated steam temperature, an additional control in the l.p. inlet is arranged automatically to shut down the stoker drives and boiler fans, and also, by opening the by-pass valve, to permit the major amount of low-temperature steam to pass to the i.p. cylinder. This control also visibly and audibly warns the operating staff.

The l.p. cylinder of each of the twelve turbine lines is designed for central steam admission and axial flow, each steam outlet being connected to a separate condenser. The condensing plant of the turbine units Nos. 1 to 4 is of Vickers' design and construction, and that of units numbers 5 to 8 is of Weir's design and construction. Each pair of condensers is so arranged that the circulating water, condensate, air and drain connections can be isolated on one or the other half of the pair, so that cleaning can be effected on the shut-down half with the unit running on reduced load.

The principal increment in feed-water temperature between the condensate and delivery to the boiler units is effected by steam bled from three stages of each turbine, augmented by subsidiary stages from other sources. The temperatures and bleeding pressures are slightly different for the various turbines, but fig. 9 depicts the feed-water cycle common to all.

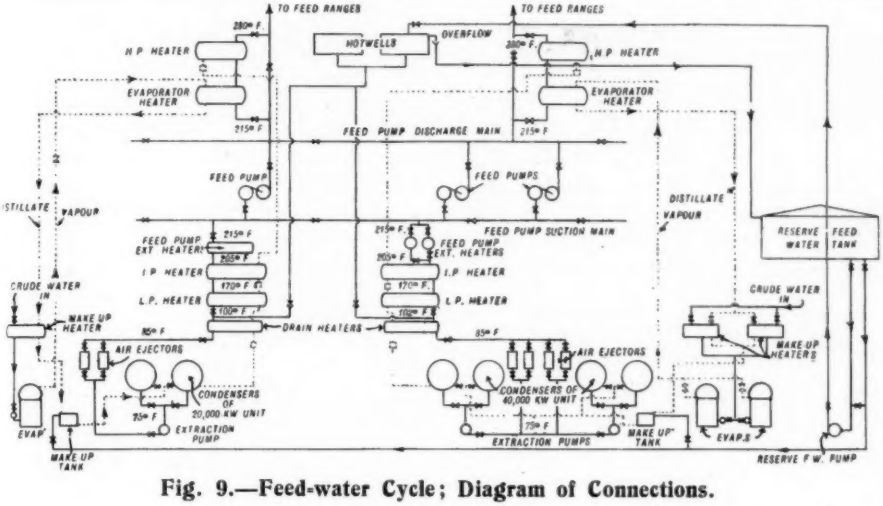


Fig. 9.—Feed-water Cycle; Diagram of Connections.

In the case of turbine units Nos. 1 to 4, the condensate, at a temperature of approximately 185 deg. F. on the 20,000-kW sets and 210 deg. F. to 215 deg. F. on the 40,000-kW sets, passes to the feed-pump suction, but in the case of units Nos. 5 to 8, feed-pump exhaust heaters are interposed between the i.p., bled-steam heater and the feed-pump suction, to which the condensate passes at a temperature of approximately 215 deg. F. The last stage in the cycle is provided by steam bled from the h.p. turbine at about 70 lb. per sq. in. absolute. With this last increment in temperature the feed water passes to the boiler-house feed ranges, at temperatures between 260 deg. F. and 280 deg. F.

Incorporated in the feed-heating plant on each turbine unit is an evaporator of the usual single-stage coil type, having steam in the coils and raw water in the shell, each designed for an output of 7,000 to 8,000 lb. of distilled water per hour. These evaporators are provided for the distillation of feed-water make-up, either from raw water from the Thames or from the South Essex Water Company's mains. Economical operation of these evaporators can only be obtained when the turbine to which they are connected is in operation. To provide an independent source of make-up water supply a multiple-effect Weir evaporator and deaerator is installed, operated directly from main-range steam and having an output of 50,000 lb. of chemically pure and deaerated water per hour.

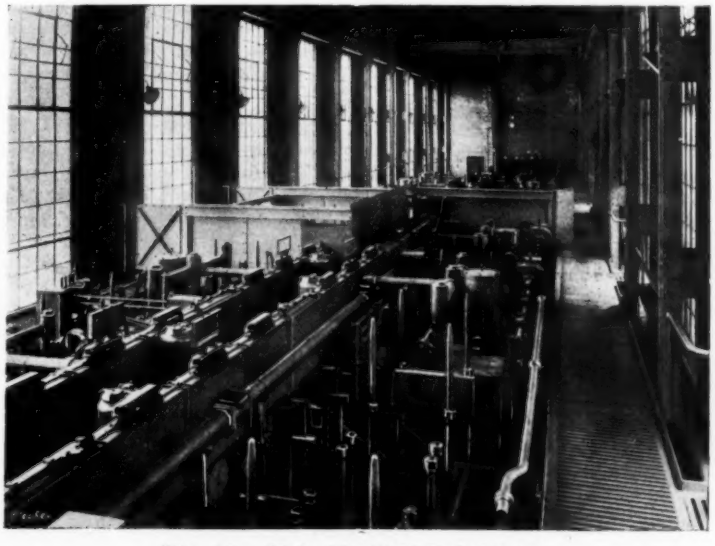


Fig. 10.—Main 33,000-V Switchgear.

In addition to the usual necessary pressure gauges, the following instruments are provided on each turbine control panel; a " Kenotometer " for the measurement of condenser pressure, two Cambridge multiple-point temperature indicators, an instrument panel with mercury depth gauges and electrically operated " full " and " empty " warning Fox signs for each group of river and town-main water tanks and the two reserve feed-water tanks, and two " Dionic " automatic water-testing outfits. The condensate from each turbo-alternator set is, in the case of units Nos. 1 to 4, metered by a Kent indicating and integrating " Venturi "-type instrument, and in the case of units Nos. 5 to 8 it is measured by "Electroflo" meters. For turbine testing purposes two groups of condensate-weighing tanks are installed.

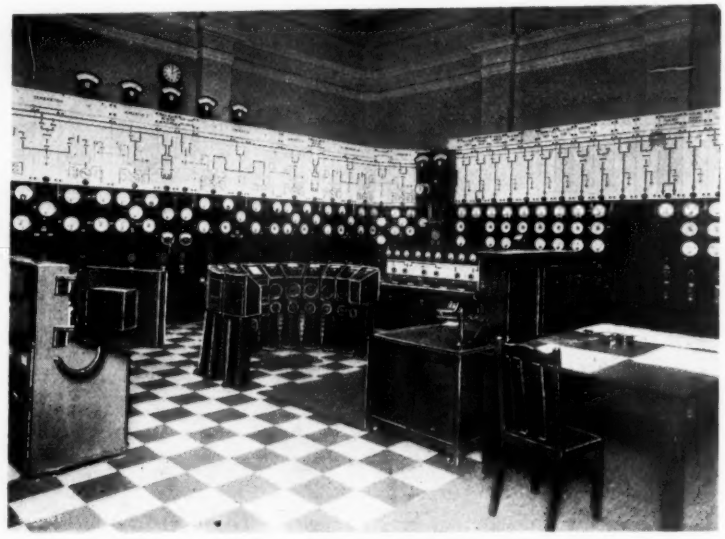


Fig. 11.—Control Room.

The main switchgear, fig. 10, is of the ironclad Reyrolle " M " type, arranged in four separate switch rooms, capable of being isolated each from the other in case of emergency. Additional 33,000-volt switchgear of Reyrolle " R " type is installed in the switch-house, ground floor. These " R " type electrically-operated circuit breakers are provided for the 40,000-kW turbo-alternator sets. Each " R " switch connects the step-up transformers of each half of a 40,000-kW unit to one single " M " type circuit breaker in the main switchgear assembly. Each of the main step-up transformer banks is provided with a neutral earthing switch connecting the star point of each transformer to a common current-limiting resistance connected to earth.

The supply to the electrically-driven station auxiliaries is at two pressures. Generally, the larger motors operate at a pressure of 2,750 volts, but the smaller gear, such as small pumps, stoker drives, coaling plant, &c., operates at 415 volts.

The auxiliaries of each turbo-alternator unit are supplied from a unit transformer connected to a tapping between each alternator and its step-up transformer. This unit transformer has a capacity of 500 kVA and steps down to 2,750 volts, with a further auxiliary-unit transformer stepping down to 415 volts. Providing a duplicate supply for these auxiliaries, and also to supply the other auxiliary plant, four 4,000-kVA transformers are installed, stepping down from the main-busbar pressure of 33,000 volts to 2,750 volts. The 415-volt auxiliaries, other than those supplied by the auxiliary-unit transformers, are supplied by transformers in the boiler houses and in the pump house, stepping down from 2,750 volts to 415 volts.

The principal 33,000-volt and 2,750-volt switching operations are effected from the operating panels in the control room, fig. 11. The panels for generator control form one group in the form of a double-sided switchboard, the front containing all the necessary indicating instruments and manual controls, while the panels at the back carry the Merz-Price protective-gear relays, voltage regulators and watt-hour meters. Two separate groups of panels, one on either side of the control room, are provided for the control of feeder switchgear and the 33,000-volt supply to the station transformers. These groups also are in the form of double-sided switchboards, the indicating and manual controls being on the front panels, with protective gear relays on the back. Arranged on top of these three groups of control panels is a diagram of the busbar system, showing all the 33,000-volt main and subsidiary switches. This diagram consists of line indicators, which are electrically operated from the mechanism of the switch to which they refer. Their position on the diagram shows quickly whether the switch they refer to is open or closed. A semi-circular group of control panels of the desk type in the centre of the control room carries in each panel the remote control gear for the turbine governor motors, and the hand-wheel for operating the exciter field rheostats. Each panel also contains the transmitter for the turbine telegraph system.

To revert to the coal-handling plant, it should be mentioned that there are installed two No. 65 "Avery" weighers and totalisers, each having a capacity ranging from 45 to 90 cwt., and each capable of handling 200 tons of coal per hour. The machines are fed by a crane, the grab of which has a normal capacity of $3\frac{3}{4}$ tons. They are entirely automatic in their action, and the counters on them register the totalised amount of the grab loads, so that the amount of coal handled can be read at any moment. They are also fitted with a patent light signal which remains alight during the weighing operation and is visible to the crane driver, so that he can tell when to dump the next grab load of coal into the machine.

The consulting engineers to the company are Messrs. Merz & McLellan, under whose supervision the station has been constructed.

We are indebted to Sir Harry Renwick, Bart., K.B.E., chairman and managing director of the Company, for permission to view the station and publish the above account, and to Mr. W. J. H. Wood, M.I.E.E., engineer-in-chief, for assistance in compiling the above notes.

Perak Hydro-electric Development.

British Insulated Cables, Ltd., report that they have just completed an extensive contract for the erection of power lines for the Perak River Hydro-Electric Company, in the Federated Malay States. The scheme consists of 66,000-, 22,000-, and 6,600-V transmission lines, and it was necessitated by the rapid growth of the tin-mining industry. The 66,000-volt lines are over 60 miles long, and take their supply from the main hydro-electric station at Chenderch. In addition to the tin mines, the scheme serves the rubber estates and the various townships in the district. The natural difficulties to be surmounted made the undertaking unusually arduous. Thick jungle had to be cleared before beginning to erect the transmission towers, while parts of the transmission routes lay in swampy districts, where, as may be imagined, it was no easy matter to erect steel towers from 50 to 60 ft. high. Tigers, panthers, and crocodiles added to the interest of the work.

Illuminating Engineering.

Some modern tendencies, the fulfilment of which is made possible by the low cost of efficient lighting.

By JOHN W. T. WALSH, M.A., D.Sc., M.I.E.E.

(*President, Illuminating Engineering Society; Honorary Secretary, International Commission on Illumination.*)

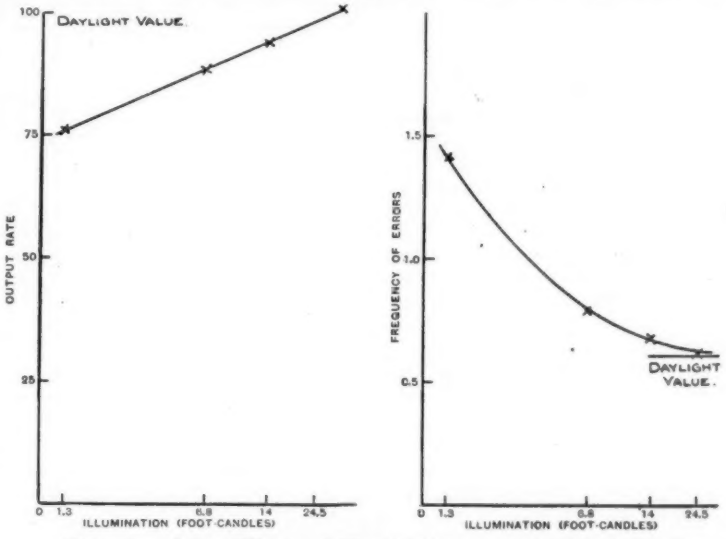
THE comparative cheapness of light now-a-days has made it possible for the illuminating engineer to pay attention to many aspects of his subject which previously, although of considerable academic interest, could find no practical application in the ordinary course of his work. Decorative lighting and the use of coloured light are, for this reason, of quite modern growth, while, even in the matter of providing adequate illumination on the working plane, remarkable developments have taken place within the last few years.

Experiments have been carried out repeatedly to prove that many operations can be performed more quickly and with greater ease if the illumination provided be increased. As far back as 1908 an investigation showed that the speed of reading increased with the illumination, at any rate up to a value of about 3 to 4 foot-candles, although at that time 1 foot-candle was commonly regarded as suitable for reading and 4 to 5 foot-candles was advocated only for the finest processes carried out by artificial light. The truth is that these recommendations were based on the current practice of illuminating engineers, and were made with a regard to the economic aspect of the subject. In no case were the values based on direct experiment and this is not to be wondered at, because experiments of this kind are very difficult to carry out and the results obtained may be very misleading unless they are interpreted with great care. Much depends on the nature of the process carried out under the various degrees of illumination. Especially, the reflection factor of the material on which the work is performed has a marked influence, since it is not illumination *per se* that the eye perceives, but brightness, *i.e.*, the product of the illumination and the reflection factor. Thus it might reasonably be expected that, if work on a white material proved to be benefited by increasing the illumination to at least 10 foot-candles, similar work on a dark material might be equally benefited by the provision of illumination up to at least 100 foot-candles. The fineness of the work, too, must necessarily exert a marked influence on the results, so that it is difficult, if not impossible, to apply results obtained on one process to another process of a very different kind.

These facts, no doubt, are more than sufficient to explain the discordant results obtained by various investigators. Even for any given process it is by no means easy to obtain reliable results. One of the most careful investigations of this kind was that recently carried out jointly by the Illumination Research Committee of the Department of Scientific and Industrial Research and the Industrial Health Research Board of the Medical Research Council. The process chosen for the investigation was type-setting by hand, and it was found that both the rate of work and the accuracy of the work were improved by increasing the illumination at least as far as 15 to 20 foot-candles. Fig. 1 shows how the speed of working was improved as the illumination was increased, and fig. 2 shows the diminution of the number of errors made.

From what has been said already it is clear that there is no justification for concluding, from these results, that the speed and accuracy of carrying out other types of work, *e.g.*, clerical work, tailoring, &c., will be improved by increasing the illumination to 20 foot-candles and that above this value no improvement is to be expected. Each type of work needs a special investigation, and it may well prove that for certain processes the illumination may advantageously be increased to, say, 50 or 100 foot-candles, while for other kinds of work no improvement may result after the 5 foot-candle mark has been passed.

A perusal of the report on the investigation into type-setting will show how difficult, and sometimes costly, such experiments are likely to be, so that it is not probable that similar figures can be laid down for all processes within a short period of time. Such figures are necessary for all the most important classes of work, however, if the illuminating engineer is to be in a position to plan his lighting systems intelligently and to advise confidently on the degree of illumination to be provided.



Figs. 1 and 2.—Effects of Illumination on Output and Quality.

Equally important with the provision of adequate illumination is the avoidance of glare. This has long been recognised by illuminating engineers, for in the early days of illuminating engineering the slogan "light on the object and not in the eye" was frequently quoted, and equally often ignored by those who regarded "plenty of light" as the sole criterion of excellence of a lighting system. Even to-day this fallacy is not entirely dead, but at least no professing illuminating engineer can now-a-days wilfully ignore the abundant evidence before him that any very bright object in the field of view causes a serious diminution in the facility with which the eye can carry out the tasks which it is expected to perform.

Until quite recently, all that it was considered necessary to do was to place the actual light sources out of the field of view, either by putting them high up or by surrounding them with shades, which might be opaque or translucent. It is now realised that this is not

sufficient. It has been shown experimentally that the eye cannot adapt itself instantaneously when the gaze is transferred from a surface of one brightness to another surface having a different brightness, either greater or less. In other words, when the eye looks first at the general surroundings which have a certain average brightness, and then at the page of a book or the surface of a piece of work having a very different brightness, it is some appreciable time before the eye can adapt itself to the new conditions and perform its work at maximum efficiency. The time required for this adaptation to take place depends, as might be expected, on the actual values of the brightnesses involved and on the ratio of one to the other. Some experimental work has been done on this subject, and it has been found, for example, that it takes 1½ seconds for the eye to adapt itself to a brightness change of 1 : 30 when the lower brightness is 3 candles per sq. foot, *i.e.*, the brightness of a piece of white paper having an illumination of about 10 foot-candles.

Now the brightness of an opal glass bowl of an average diameter of 20 inches, enclosing a 200-watt lamp, is about 90 candles per sq. foot, so that, if the eye encounters this immediately before looking at a book placed where the illumination is 10 foot-candles, it will be at least 1½ seconds before the eye will be able to read with perfect ease and rapidity.

It will be seen that this extension of our conception of what constitutes "glare" must involve a very marked alteration in practice as regards the positions chosen for lighting fittings and the precautions taken to prevent the eye from viewing these fittings directly. It may or may not be a coincidence that just at this time a most remarkable development in illuminating engineering has taken place and that this development, often referred to as "architectural lighting," provides the possibility of satisfying all the requirements as regards glare prevention.

In architectural lighting the lighting unit is incorporated in the structure of the building, so that it forms an integral part of the architecture instead of being, as so often in the past, an obvious after-thought. Luminous panels in walls or ceiling, lighted columns or door-lintels, and lighted caps of columns are frequently used, while cornice lighting and other methods of indirect lighting are very effective if supplemented by some fitting giving a direct component. The luminous panels, &c., are sometimes constructed of a completely diffusing material, such as opal glass, but more frequently an acid-etched or sand-blasted glass is used on account of its greater efficiency. It will naturally be understood that the efficiency of such a system of lighting, expressed in terms of the illumination on the working plane produced by the expenditure of a given amount of electrical energy, is considerably lower than that of the older systems of lighting by semi-indirect or similar units suspended from the ceiling.

The lighting of the exteriors of buildings has developed very rapidly within the past few years. Flood-lighting by means of projectors specially designed to throw a wide-angle beam of light on the wall of a building has made some progress, but it is hampered by local authorities' bye-laws, which severely limit the distance in front of a building at which it is allowable to place the projectors. In the case of a high building the upper portions of which are "stepped-back," the difficulty may be overcome, and the new headquarters of the Underground Railways at St. James' Park is typical of a successful installation of this kind. Possibly this restriction on the use of flood-lighting is responsible for the more rapid development of other forms of lighting for the exteriors of buildings. Canopies containing very large numbers of lamps are now frequently erected for the entrances both to shops and to kinema theatres.

Shop window lighting has shown continuous improvement during the last ten years or more. The improvement lies not so much in the amount of light provided as in the constantly increasing recognition of the principles of good lighting. The sources are frequently concealed from view and the distribution over the goods displayed is quite sufficiently uniform without being "flat." It is amply evident that shop windows are now generally designed so as to provide for ample and suitable lighting after dark.

One branch of illuminating engineering has shown remarkable progress within the past three or four years, *viz.*, the lighting of streets and open spaces. The tendency here is to use greater mounting heights for the units, and to provide optical or other devices for redirecting the light from the source so that much more of it reaches the darker areas than would be the case if no such devices were employed. No doubt the issue of the British Standard Specification for Street Lighting has contributed largely to the increased interest in the subject and so to the improvement which has undoubtedly taken place. There seems to be as yet no marked tendency towards any particular arrangement of the units on plan; central suspension, a staggered system, and opposite pairs are still in common use everywhere. There is a noticeable tendency to increase the candle-power of the units. The directive devices are generally designed to give a maximum candle-power at an angle of about 70 deg. from the downward vertical. A recent development has been the rapid increase in the use of "asymmetric" directive devices, *i.e.*, devices which, instead of increasing the candle-power at 70 deg. elevation for *all* angles of azimuth equally, give two more or less concentrated beams directed along the roadway. If the axes of these beams are, in plan, both parallel with the centre line of the street, the fitting is usually referred to as "axial" asymmetric, but a very recent development has been to use a non-axial asymmetric distribution, *i.e.*, to bend both beams inwards towards the centre of the roadway. It is too early yet to say much about the road-users' experience of these various systems.

A consequence, no doubt, of the cheapening of light has been the increased use made now-a-days of coloured lighting, chiefly for display and advertising purposes. Except for the provision of variety or the enhancement of the appearance of some particular scene or object, there does not seem to be much practical advantage to be gained by the use of positively coloured lights. The alteration of the colour of the light given by an artificial illuminant to simulate the colour of daylight is, however, quite another matter, and the use of artificial daylight has increased enormously within the past few years.

There are two principal uses to which artificial daylight may be put. In the first place there is the accurate matching of coloured materials, such as dyed textiles, sugar, cigars, printed papers, &c. In some cases, notably the so-called "sensitive tints," the matching cannot be carried out satisfactorily unless the light provided is a very accurate imitation of daylight, not only as regards the general colour sensation produced on the eye, but also as regards the energy distribution throughout the visible spectrum. Such "colour-matching" units have been greatly improved of late years and their use is consequently extending rapidly. It may be said, in fact, that the variations in natural daylight, even under more or less definite meteorological conditions (*e.g.*, overcast north sky), are greater than the differences between such natural daylight and the light given by a well-designed artificial daylight unit.

There is the second use to which artificial daylight may be put, *viz.*, in rooms, offices, workshops, &c., for the provision of general lighting having the same colour effect on the eye as natural daylight. Opinion seems very much divided on the merits of such a system of illumination, but there is no doubt that in certain circumstances it is of immense value. In a basement room, or a deep room with a badly obstructed outlook, it is often necessary to supplement the daylight received through the window by switching on the artificial light. The result under ordinary conditions is a "mixed light," which most people find very objectionable and uncomfortable for working. If, however, artificial daylight is provided instead of ordinary artificial light, this unpleasant effect completely disappears, and the natural lighting of the room can therefore be made use of to its full extent, even at periods of unusual dullness or towards nightfall.

Electricity and the Gramophone.

A survey of the applications of electricity to gramophone work for recording, reproducing, and driving.

By STUART F. PHILPOTT, A.M.I.E.E

THE boom now being enjoyed by the gramophone is directly due to the application of electrical principles to that instrument. The advent of electrical methods of recording was one of the greatest advances yet made in the history of the gramophone. All records are to-day made by the electrical process, and the acoustic process in use up to about three years ago is completely obsolete.

It should be mentioned here that a gramophone record consists of a wax-like composition disk on which is cut a long spiral groove. Along the sides of this groove are undulations produced by the recording sound, which, by the passage of a needle over them, cause that sound to be reproduced. The volume of sound so obtained depends on the amplitude of the waves in the groove. In the old system of recording a large diaphragm was provided at one end of the recording studio and coupled to a cutter under which traversed the record to be cut. Vibrations of the diaphragm, due to sounds impinging on it, were therefore transmitted to the cutter, and the amplitude of the recorded sound waves depended on the intensity of the original sound. This called for a small studio and a correspondingly small number of performers who had to be grouped round the diaphragm. The system had several other disadvantages, the chief being that reproduction was not at all lifelike or regular. The notes at the upper and lower ends of the musical scale were not reproduced at all, and practically all the harmonics were cut out, so that the music lacked quality.

In the electrical method of recording a microphone and valve amplifier are used, similar to those used for broadcasting, and the output is made to work the cutting needle. Thus the amplitude of the sound waves impressed on the record no longer depends on the strength of the sound received, but it can be varied at will. The microphone can be taken to the performer, if desired, instead of the performer to the microphone, and, of course, it is no longer necessary to limit the number of performers in any way. The "quality" of electrically-recorded music is very high, and a much wider range of musical scale is covered. Furthermore, the needle note or "scratch" always present with the old type recordings is now considerably lessened.

The latest application of electricity to the gramophone is the electric "pick-up" and amplifier for reproducing the recorded sounds, by which very fine results are obtained. The ordinary method of producing sound from a record is shown diagrammatically in fig. 1, where A is a section of a record, B is a needle running in the sound groove C and held in a stylus bar D pivoted at E and rigidly connected to diaphragm F, suitably mounted, which is often of mica or light metal. The vibrations of the needle as it passes over the record are transmitted to diaphragm F, producing sound which is amplified by a trumpet attached to the outlet G. A volume of sound produced is primarily dependent on the magnitude of the vibrations of needle B. In the electric pick-up shown diagrammatically in fig. 2 the needle and stylus bar are retained, but the diaphragm of fig. 1 is replaced by an armature A. This vibrates in front of the poles of a magnet system and so causes a varying e.m.f. to be induced in the coils C.

The sound can be heard by connecting an ordinary telephone receiver to the output of the pick-up, but it is more usual to feed into a one-, two-, or three-valve low-frequency amplifier and listen to a loud-speaker. An amplifier as used in a radio receiver is quite suitable.

The pick-ups on the market all work on the principle of fig. 2, but vary considerably in construction and efficiency of performance. The chief problems encountered in their design are the damping out of unwanted self-induced natural vibrations and, at the same time, retaining sufficient flexibility of armature movement to prevent undue record wear. The electrical reproducing system has several advantages over the acoustic method, *viz.*: the volume of sound can be controlled as desired by adjusting the amplifier; the electrical reproducer, given a suitable loud-speaker, has a considerably wider musical range than the ordinary gramophone, though in fairness to the latter it should be said that tremendous strides have lately been made in the science of sound-box and trumpet design; the music can be reproduced at any number of points by wiring loud-speakers in parallel, this being a great advantage in kinemas, dance halls, and the like; and, the amplifer of an electrical gramophone and a radio set being identical, it requires very little additional expense to make a combined radio and gramophone set over the cost of one of them alone.

One of the disadvantages of the gramophone from the user's point of view is the necessity for winding up the spring motor at frequent intervals. Modern motors are fitted with much stronger springs than formerly, on account of more power being required to rotate the electric records, hence the physical power required to wind a gramophone has increased considerably. It is not surprising, therefore, that during late years there has been

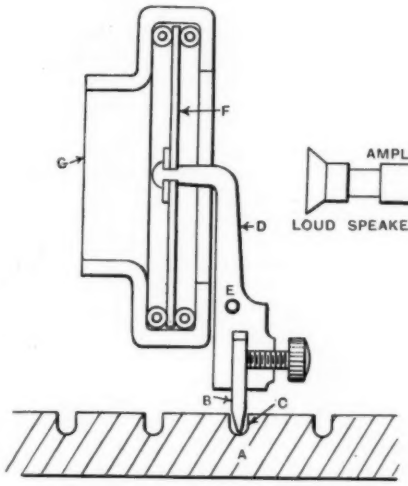


Fig 1.—Principle of Acoustic Gramophone Sound Box.

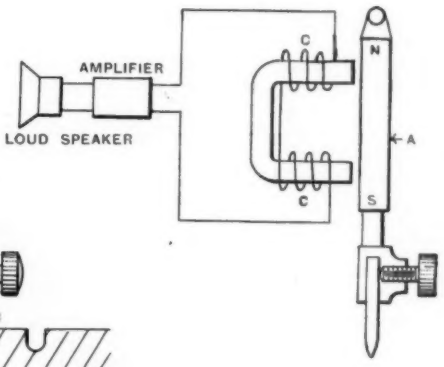


Fig. 2.—Principle of Electrical Pick-up.

an increasing demand for an electric gramophone drive, and a number of firms have set out to meet the demand. The application of the electric motor to the gramophone is, of course, not a new idea, but it is one which presents rather more difficulty than the general run of electric drives. The chief troubles encountered are the maintenance of a uniform speed of rotation of the record table, despite fluctuations, sudden and otherwise, in the voltage of supply, the suppression of motor noise, and general unevenness in playing.

These problems have now been successfully overcome, and modern electric gramophone motors fulfil all requirements. The majority on the market comprise a very small universal or squirrel-cage induction motor arranged to drive the record-table shaft by some means, *e.g.*, by friction of its pulley on another wheel, or on a rim on the underside or edge of the table, by gearing or by belt drive, the last mentioned method being the most satisfactory. A centrifugal governor is fitted at some point in the mechanism to maintain constant speed. The motor is usually wound for something below 100 volts, and a series resistance is fitted to make the same motor adaptable for all voltages. The resistance also acts as a buffer to minimise fluctuation in main voltage. Sometimes a lamp is used for a resistance, but the wire-wound type is more generally favoured. Special care has to be taken to insulate the motor acoustically from the cabinet. This is usually done by mounting the machine on rubber blocks.

These three applications of electricity to the gramophone constitute the main uses at present, but electricity is also used to some extent in other directions, such as electric winders for existing machines, record changing devices, &c., but not sufficiently to warrant attention.

High-voltage Measurement.

Principles underlying accurate determination of electrical pressures and a consideration of various methods of measurement.

By J. PLUMMER, A.C.G.I.

DEVELOPMENT always makes demands upon the resources of the manufacturer, and research must be continually in progress anticipating newer and more stringent demands. It follows then that cable manufacturers have their factories equipped with high voltage testing laboratories,[1] where pressures which are multiples of the working cable pressure are used to study the behaviour of the cables when subjected to these pressures, to obtain comparative results, and to be able to guarantee performance under stated conditions. It is impossible to imitate all practical conditions of working in the testing of " super-voltage " cables, but tests have nevertheless been designed to give indications which will be valuable in predicting the performance of cables in service. The tests which are usually carried out consist of high-pressure tests, load at full working voltage, thermal resistance, dielectric loss and power factor tests, breakdown tests, and wave-form of current and voltage in special cases. These tests necessitate the accurate measurement of the applied voltage or the determination of the maximum potential stress, the power losses in core and dielectric, the variation of dielectric loss or power factor with temperature, or of conductor temperature by the change in resistance method, and all of these measurements may have to be carried out whilst the apparatus is operating at a high potential.

It is useless to read the applied voltage on the low-pressure side of the testing transformer and trust to the ratio of transformation to give a measure of the test pressure, owing to the earth and inter-coil capacitance associated with the high-pressure winding and also to the fact that the ratio changes with the magnitude and phase angle of a capacitance load. The vector diagrams (figs. 1, 2, 4 and 5) will make this clear. They are not to be taken as representative of a typical case, as they have been purposely exaggerated to show the components clearly. In fig. 1, which represents no-load conditions (with secondary e.m.f. vector omitted), I_m is the magnetising current corresponding to a particular primary voltage V_p, I_c is the charging current in the transformer dielectric for the same voltage, and I_h is the loss or energy component of the no-load current I_o. These three components do not exist separately, but combine to form I_o lagging (or leading) V_p by an angle ϕ; the fictitious components are used to simplify the discussion. If, as may be the case, I_c is less than I_m (fig. 1) then I_o lags behind V_p, and the primary back e.m.f. $-E_s$ (which is related to the secondary e.m.f. by the turns ratio) is less than the applied voltage V_p, but if I_c is greater than I_m then, as shown in fig. 2, $-E_s$ may be greater than V_p. Now theoretically I_c is directly proportional to the voltage responsible for it, but I_m depends upon the imperfection of the iron circuit and will not increase at the same rate as I_c. Hence it is seen that as the low-pressure voltage is raised, the conditions may change from those in fig. 1 to the conditions depicted in fig. 2. At the highest voltages, fig. 2 represents the general case.

Consider now the vector diagrams shown in figs. 4 and 5. The former represents the conventional 1 : 1 ratio transformer with inductive reactive load, and shows the relationship between primary and secondary terminal voltage and primary and secondary e.m.f. Fig. 5 shows the effect of a capacitance load (*e.g.*, the charging current in the cable dielectric) on a transformer whose no-load current already leads the primary voltage. In this case it is seen that the ratio v_p/v_s may differ considerably from the ratio $-E_s/E_s$. Further, the ratio v_p/v_s will change with load and also with variations in v_p, although the ratio $-E_s/E_s$ theoretically remains constant. Hence the secondary voltage must be accurately measured at the point of application by instruments which either introduce no error, or have been compensated for varying conditions, or to the readings of which known corrections may be applied.

The importance of accurate voltage measurement may further be illustrated as follows: Suppose that, for example, cable dielectric loss is determined by means of a standard wattmeter such as the Duddell-Mather instrument. Then the wattmeter reading $w(=vi\cos\phi)$ will enable the power factor ($\cos\phi$) to be calculated, if v and i (the high pressure and charging current respectively) are accurately known. Since $i=cv\omega$, we may eliminate i from the expression and write $w=\omega cv^2\cos\phi$, which shows that, if c the capacitance of the cable and

[1] Electrical Review, Vol. 103, p. 383 (Sept. 7th, 1928); Vol. 106, p. 224 (January 31st, 1930). See also Electrical Review, Vol. 104, p. 375 (March 1st, 1929); Vol. 105, p. 967 (November 29th, 1929), and Vol. 106, p. 438 (March 7th, 1930).

the testing pressure are known, then (for these conditions, the power factor is inversely proportional to v^2, and this emphasises the importance of an accurate determination of v. Now, as an alternative to the Duddell-Mather wattmeter, the high-pressure Schering bridge[2] will give the capacitance and power factor at a particular value of the testing voltage, and it will be necessary to know the value of v at each test so as to be able to trace any variation of the power factor with the testing voltage. Also, as c and cos ϕ are given by the Schering bridge at a particular voltage, then corresponding to that v will be $w = \omega c v^2 \cos \phi$, from which it is seen that the dielectric loss can be calculated without a knowledge of the charging current. If required, the charging current could be found from a knowledge of v and the test frequency. In each case v must be accurately known.

One method of measuring high pressures up to 75 or 80 kilovolts is to make use of a high resistance connected across the test voltage, and to measure accurately the current passing through this resistance. Usually the resistance is sub-divided into a number of sections which may be mounted in galvanised iron tanks supported on insulators. In order that the resistance may form a fairly accurate reference standard it is essential to reduce to a negligible quantity the capacitance between resistance and earth by connecting the tanks to tappings from a condenser potential divider. For voltages above 80 to 100 kV, sphere gaps are commonly used. In certain testing laboratories, the high pressure is measured in terms of the charging current in a special air condenser of known capacitance at a standard frequency (see Electrical Review, March 7th, 1930).

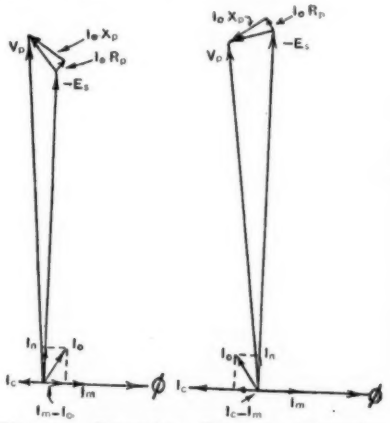


Fig. 1.—Charging Current Less than Magnetising Current.

Fig. 2.—Charging Current Exceeds Magnetising Current.

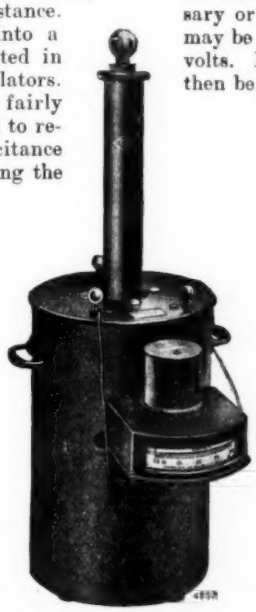


Fig. 3.—A Compact Bushing-type Electrostatic Voltmeter.

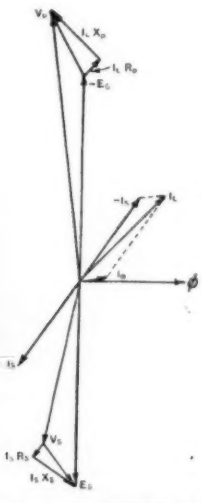


Fig. 4.—Relationship of Primary and Secondary Voltages.

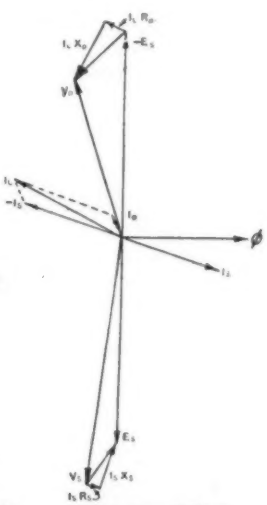


Fig. 5.—Effect on Transformer of a Capacitance Load.

Probably the simplest and most useful method of measuring high voltages is to make use of an electrostatic voltmeter of the Ayrton and Mather type in conjunction with a condenser bushing. An outfit of this type suitable for pressures up to 30 kilovolts is illustrated in fig. 3; the practical limit to the voltage which may be measured depends on the limitations in the bushing itself. The principle of the condenser bushing is quite simple and has been described in articles on switchgear.[3] It consists of a central conductor (forming the high-pressure terminal) encircled by a number of concentric insulating tubes arranged with metallic intersheaths to control the distribution of the potential gradient from the inner conductor to earth; the sheaths are thus at diminishing potentials above earth depending upon their distances from the central conductor, or, in other words, depending upon the radii of the intersheaths. The construction is practically a number of condensers in series, the last condenser being formed by the last intersheath and earth. By connecting an electrostatic voltmeter across this last condenser, the instrument may be used to indicate the maximum r.m.s. voltage on the bushing. The last step of the bushing is condenser adjusted to suit the instrument.

This system has many advantages. In the first place the voltmeter may be standardised for a maximum working pressure of, say, 1,000 volts (a scale factor being applied for high-voltage measurement) when the working forces are comparatively large. It is then possible, on account of the relatively low maximum voltage, to bring the voltmeter out of the high-pressure enclosure and to mount the instrument on the control switchboard, where it will be in a convenient position for reading. If necessary, the leads to the voltmeter may be carried through a suitable screening tube and the correction due to the added capacitance allowed for at the time of calibration. Alternatively, when this screening is unnecessary or when corrections are negligible, the instrument may be used quite simply to its maximum range of 1,000 volts. It may be calibrated at any time on d.c. and may then be used (through a selector switch) on either a.c. or d.c. circuits. A single instrument calibrated for use with different bushings can be used, or, if requisite for greater sensitivity, with a selector switch to connect with the last step of bushings designed for different maximum voltages. Another use for the instrument when calibrated to 1,000 volts maximum and used with a selector switch would be to measure the low-pressure voltage on a testing transformer directly, and then cross over to the condenser bushing connected to the high-pressure winding and so check the ratio of transformation both on no-load and also on loads of varying power factor, or at different power factors, lagging or leading.

The particular instrument illustrated has a scale marked from 0 to 30 kilovolts; the first scale graduation commences at 5 kV and the rest of the scale from 10 kV upwards is subdivided to 0.2 kV, readings being easily possible to 0.1 kV. To a fair degree of accuracy it should be possible, by estimation, to take a voltage reading to the fourth figure, for values above one-third of maximum scale reading.

The whole outfit forms a comparatively small and compact arrangement (that illustrated being 38 by 33 by 97 cm.), and the importance of this, together with the sustained accuracy of the electrostatic voltmeter, cannot fail to be appreciated by supply and distribution engineers and others who have to anticipate dealing with pressures which the grid system has called into being. In conclusion, the author wishes to thank the Cambridge Instrument Co. for permission to reproduce (in fig. 3) the illustration of this instrument.

[2] *Zeitschrift fur Instrumentenkunde*, Vol. 40, p. 124 (1920); Vol. 44, p. 98 (1924). Also *World Power*, Vol. 5, p. 238 (1926).

[3] Electrical Review, Vol. 101, p. 990 (December 9th, 1927) and *Electrician*, Vol. 102, p. 493 (1929).

Electricity for the Home.

Domestic Electricity in all its Phases.

By N. A. CHESTERFIELD,

Commercial Superintendent, Fulham.

IT is a long cry since Faraday and other intellectual giants, with profound knowledge and wisdom, laid the foundations for the introduction of the dynamo and vacuum lamp, and the progress since those days in the use of electricity is almost inconceivable.

What has arisen since 1881? Wireless, telephony, electric trains, electrically-propelled ships, electrical workshop equipment, the kinema, electro-medical apparatus, electric street lighting, and, last but not least, the development of electricity for the home. The Act of 1882 gave powers to the Board of Trade to license any local authority or company to supply electricity. By the provisions of this Act every local authority had the opportunity of setting up its own undertaking, but so many had the limited view of the parish pump and failed to take advantage of opportunities given. Had a wider vision been exercised at that time, adjoining local authorities, when taking up their provisional orders, might have agreed to put up joint generating stations in central positions, a great amount of money in capital outlay would have been saved, and development would have been much more speedy than has been the case, because their amalgamated forces would have produced more cheaply and have commanded a greater market for their output. It would also have obviated, perhaps, the necessity for setting up super stations and grids, which have apparently become essential for the co-ordination of generation and supply to-day.

It has long been recognised that with modern development a two-part tariff is necessary, but seemingly an equitable basis is hard to find. Wright's maximum demand indicator system served its purpose in bygone days, and the kW demand system of charging is still available and workable for factory and workshop, but a suitable two-part domestic tariff is a more difficult problem. Let us attempt a survey of the working of a few existing two-part tariffs.

Rateable Value Basis.—This system, whilst it looks reasonably fair all round, does not work out quite so satisfactorily in practice, for the reason that premises in one part of any district are rated differently from premises of similar accommodation in other parts of the same district. Further, neighbours in a street, one paying a controlled rent and the other living in a de-controlled house, having the same accommodation, would be called on to pay different rates, and in the case of the de-controlled house a much heavier rate.

Room Area.—This system tends to favouritism, unless the job is done by thorough and systematic measuring of each house or flat, and would entail the employment of an army of surveyors for the job; otherwise the alternative is a haphazard decision as to rating.

Lighting-point Charge.—The system of basing the first or "standing" portion of a two-part domestic tariff on the number of lighting points installed appears to be the most equitable. It has the advantage of being a basis of charge for electricity supply founded on the quantity of "light source" installed, and not on some extraneous factor. It has the further advantage of simplicity, which all undertakings are striving to achieve, and it is easy to explain to the public.

On this very debatable question of tariffs I suggest that as the use of electricity becomes more general in the home it may be possible to pay for our electricity on a "lighting-point," or similar tariff, varied to differentiate between the purely lighting and light-heat-cooking installation. We do not buy our water through a meter —why electricity? Should such a scheme be brought about it would save the undertaking the cost of meters and meter reading, and the consumer the objectionable charge of meter rent. In addition, the accounts could be rendered at the beginning of each quarter similarly to the water-rate demand, with the further advantage of having accounts paid in advance each quarter, thus assisting the finances of the undertaking. This probably sounds Utopian, but I feel, at the same time, that it may become in a few years a matter of practical politics.

Of course, in the present stage of flux due to the grid system and the advent of the Central Electricity Board and Joint Electricity Authorities, until we know the basis of their charges per kW for our demand, plus the kWh charge, it will be difficult for any undertaking to fix tariffs with any certainty. In this connection it would seem that the bogey the public has in its mind, with the operation of the super stations, is that electricity will be available at a ¼d. per kWh. It should here and now be definitely and plainly stated that this can never be done. The kWh charge is easily understood by those of the industry as only referring to the generation of the kWh, and has nothing whatever to do with the thousand-and-one costs entailed in distributing the kWh to the consumer. There are cable charges, sub-stations for conversion, collection, meter reading, rents, rates and taxes, together with the salaries and wages of the officials and employés engaged therein.

A word, perhaps, would not be out of place at this juncture suggesting to the Central Electricity Board and Joint Electricity Authorities that they take a wide view in fixing kW charges to undertakings, so as to permit of further development of load in their respective areas. Elasticity in basing the kW demand is very essential to undertakers, for the reason that any short cold snap is likely severely to penalise undertakers who have developed large domestic loads, in so much that the heavy demand for a short period would tell against the progressive undertaking. Such circumstances should be treated as seasonal, and not as a basis for calculating the maximum demand.

Business methods of undertakings must advance with the times, as it is no longer possible to sit and wait for business. The need for electricity must be brought home to the public by means of attractive showrooms and demonstration rooms, generous rental wiring and rental apparatus schemes, publicity, and by convincing literature in the shape of attractive brochures. Showrooms should be made attractive, and, so as to bring the consumer in contact with the latest electrical productions, the accountancy department should be arranged for the personal payment of accounts at the rear of the showrooms. There should be frequent re-arrangements of the showrooms, so as to attract attention to the beauty and utility of the articles shown therein, and at times the co-operation of manufacturers should be sought to give special displays of their specific productions. It goes without saying that the showroom staff should be courteous, well informed, easy of address, and capable in dealing with all sorts and conditions of people. Preferably the demonstration room should be apart from the showroom proper. There must be nothing hazardous in the arrangement of cookers, water heaters, radiators, and other apparatus. The lay-out must be such that

prospective consumers can move freely, inspect, and discuss with demonstrators the uses and advantages of the various articles displayed. A set time in the day for cookery demonstration is no doubt attractive, and, further, it has been found at Fulham that invitations to Women's Associations in the wards of the borough in the winter months have resulted in ready acceptance, and as many as 83 have formed a party in one afternoon. The demonstration is an explanation of the various parts of the cooker; cakes, pastry, &c., are made and distributed among the visitors with a cup of tea. By these means the visitors can judge at first hand the success, cleanliness, and reasonableness of electric cooking. We also fix a meter on the cooker circuit, with a unit dial showing the amount of electricity used and the cost for each demonstration. These demonstrations have brought a large increase of business to the domestic-apparatus hire department.

To meet the growing demand of owners and occupiers of houses a cheap rental wiring scheme and a sound hire-purchase scheme should be introduced, so as to encourage the installation of electricity in the home. Fulham started a rental wiring scheme some two years ago on the basis of 10d. per point per quarter for 5 points or less, and 9d. per point per quarter for 6 points and upwards, with a small deposit for the quarterly meter, and, to illustrate the popularity of this scheme, over 3,000 consumers have taken advantage of it, and others are still coming forward at the rate of 50 per week.

It will perhaps be interesting for readers to know that our ordinary applications have been practically maintained over the period, so in this direction alone we have gained just on 2,000 new consumers per annum since the introduction of rental wiring. We have a cheap hire charge of 6d. per quarter for electric irons, and have encouraged their use on the wiring scheme, with the result that we have about 2,000 on hire, and if used for one hour only per week each iron consumes 25 kWh per annum, and this at the lighting rate. We have received no complaints, and very few irons have been returned. Having given the consumer a fair chance of judging the value of this piece of domestic apparatus, we intend following up with calls for an extension to electric cooking, heating, &c.

With regard to electric cooking, &c., Fulham felt, in introducing its scheme, that it should be hire only and not hire-purchase, for the reason that it would prove more beneficial to all parties concerned, and certainly when the hire charges have been based on a reasonable and satisfactory tariff. To demonstrate this, the charges are as follows:—

	Per quarter.
Cookers (all-enamelled)	3s. 6d. to 8s. 6d.
Kettles, 2-pt. or 3-pt., automatic ...	9d.
Water heaters, 5-gal. to 22-gal. ...	4s. 6d. to 10s. 0d.
Wash boilers, 10-gal	3s.
Radiators, 1-kW to 3-kW	1s. 0d. to 2s. 6d.
Irons, 5-lb.	6d.

In connection with this scheme the Council wires for cookers and radiators free up to 30 ft., and makes a nominal charge of 1s. per ft. run beyond. A reserve is made in the case of wiring radiators to two living rooms only, such as dining or drawing rooms. Should the consumer require bedrooms wired for radiators, a minimum charge of £2 for 30 ft. and 1s. per ft. beyond is made. The minimum contract period for cookers is two years, and for radiators three years. A two-part tariff is offered, based on 1s. per quater for each lighting point, and all current is then supplied for ¾d. per kWh. A minimum consumption of 150 kWh is required for any cooking installation. The scheme has been working just two years, and 400 cookers are installed, 700 radiators, 60 water heaters, 30 wash boilers, 400 kettles, &c., with satisfactory results. We endeavour to persuade each consumer to hire a kettle, pointing out the quickness and saving accruing from its use for boiling water over that of the boiling plate. An iron-clad control unit, with a pilot light, and a 3-pin plug for the kettle is installed with each cooker. Our maintenance charges per annum for apparatus on hire have been exceedingly small, owing to the excellence of the productions of manufacturers.

It would not, I am sure, be out of place for the guidance of manufacturers to ventilate the various problems we have met with in the design of cookers. It is regrettable that no originality is shown. All models follow the construction of the old coal and gas stoves, and the inconvenience of stooping to reach the cooker remains. Surely the time has come when this very essential point should be understood and dealt with. Of course, we have the table cooker, but in these days of kitchenettes, with their limited space, such models cannot be considered, and I feel sure that the brains of the industry which have met so many problems that have arisen so far will surmount this one and give us something original in cooker design to meet the suggested need.

Vitreous enamel has so far proved itself generally satisfactory, and should become the standard finish. It is conceivable that as time elapses the public will universally prefer this to the older type of black finish, and it would be advisable for undertakings to realise this at once and provide stoves of this type, thereby curtailing loss on the older type cooker when it is returned to the stores. Fulham has done this since last April.

Unquestionably the hire charge should include the cooker and all accessories, such as backplate, plate-rack and thermometer, and thus avoid the annoyance caused to hirers by irritating demands for extras. A simmering plate should be provided in addition to the boiling plates. All oven grids should slide on runners, or have a safety catch attached to the frame, so that the grid is supported when partially withdrawn from the oven. The hot cupboard space and depth of the grill tin should be such that sufficient room is left for warming plates and dishes, so avoiding the necessity of using the oven for this purpose.

A further general point for consideration is that of interchange elements of the plug-in type. The thermometer does not seem to be as efficient as it should be; could not some cheaper substitute, or a pyrometer, be made to take its place?

To make electric cooking the last word, has not the time arrived for all utensils, such as kettles, saucepans, &c., to be standardised, and, again, would it not be advisable to include these in the hiring charge? At the same time it would pay to consider the construction of these utensils, especially with regard to the solidity of the bottoms of the vessels, so as to ensure their close fitting position to the boiling plate, and thus to conserve the heat, which in turn would speed up the heating of the plates. More attention might be given to the quality of drip and grill tins, which generally are of very poor construction.

It has to be recognised that since the war families are very much reduced in size, dietary has changed, and entertainment in the shape of meals has considerably lessened; consequently we find from our experience that the medium-sized cooker is the one most in demand, and therefore calls for closer attention to any improvements possible in order to add to its efficiency.

It is generally known that the Electrical Association for Women has been in touch with the educational authorities for the introduction of electrical apparatus in school domestic centres, with the result that many educational authorities have adopted the system, whilst others are considering it. It is, therefore, up to undertakings to support their efforts at every opportunity.

A word to undertakings adopting hire-apparatus schemes: all articles hired should be suitably franked, showing the ownership, and a proper card index maintained. This would not only serve to record the issue of apparatus, but also all details with regard to its maintenance whilst on loan. It is not advisable to impose too many restrictions on the hire application form; they have the effect of frightening prospective consumers.

I trust these few suggestions will be of interest to manufacturers and those engaged in undertakings throughout the country, and that they will result in a general discussion on these points in the columns of the Electrical Review.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The Christmas Holidays.

Our Advertisement Department draws attention in this issue to the altered publication arrangements necessitated by the Christmas holidays. The issue of December 19th will be published a day earlier, and advertisement copy and blocks should be received by December 10th; classified advertisements can be taken up to 5 p.m. on Monday, December 15th. The December 26th issue will appear on December 24th. Copy and blocks are required by December 15th; classified advertisements will be accepted up to 9 a.m. Monday, December 22nd. The January 2nd issue will be published on the usual day, but copy and blocks should reach our Advertisement Department by Monday, December 22nd.

Industrial Electric Vehicles.

An interesting demonstration of the use of the electric storage battery for the propulsion of vehicles and trucks was given last week by the NEW DISTRIBUTORS OF EDISON STORAGE BATTERIES, LTD., in the demonstration hall of the Hackney Borough Council Electricity Department. The electric vehicle is particularly suitable for employment when continual stopping and starting is necessary, and the little 5-cwt. truck which was put through its paces in the somewhat restricted space of the hall showed how very applicable this type of vehicle is for use in factories, railway stations, and the like, where mobility as well as cleanliness and lack of smoke and fumes are points to be considered. Models for all purposes and ranging in load capacity from 5 cwt. to 15 tons are obtainable, one of the most interesting being a light delivery van which is capable of 35 to 40 miles a charge, and has a maximum speed of between 18 and 20 m.p.h. In connection with this demonstration a film entitled "Portable Electricity" was shown, tracing the whole process of construction of the Edison steel alkaline storage batteries, and illustrating the numerous applications to which they are put.

At the recent Public Health Congress the company exhibited a full range of Edison steel-alkaline traction cells, including a portion of a battery of "type A-4" cells loaned by the Blackburn Corporation Electricity Department and taken from an electric passenger vehicle which had run approximately 100,000 miles in just over 15 years. The battery is still capable of operating a vehicle ten miles on one charge.

Irish Free State Electrical Imports.

The imports of electrical machinery, apparatus, and cognate goods into the Irish Free State during September had a value of £81,472, as compared with £91,893 in September, 1929. The subjoined table shows the imports during the first nine months of the two years:—

	January to September	
	1929.	1930.
Electrical machinery	247,717	222,548
Electric wires and cables	148,810	128,648
Electric lamps and parts	52,448	66,244
Wireless sets and parts	52,864	65,570
Other electrical goods	194,646	154,881
Copper wire	67,801	33,791
Totals	£764,286	£671,682

It will be seen that so far this year there has been a decline of £92,604 in the gross imports, the only items showing increases being electric lamps and radio apparatus.

Adventures of "Ruston" Engines.

Messrs. RUSTON & HORNSBY, LTD., inform us that included in the cargo of the *Highland Hope*, which was stranded last week, were 36 "Ruston" engines which were on their way to Buenos Aires for the forthcoming British Empire Trade Exhibition. The company says that whether the last has been seen of these engines is a matter of conjecture. On a previous occasion, during the war, a "Ruston" engine formed part of the cargo of a boat torpedoed in the Mediterranean. At the end of the war the vessel was raised, the engine was sold, and was put to work by a brick company. It was subsequently sold again, and is apparently still running.

New Ericsson Telephone Works.

It is reported that the L. M. Ericsson Telephone Company proposes to erect a new telephone manufacturing works in Stockholm, which will employ about 8,000 persons, to enable it to deal with the orders which are accumulating and which are also expected from abroad.

The Leeds Electrical Club.

The Leeds Electrical Club is holding its annual whist drive and dance on December 5th. Tickets may be obtained from any member of the committee or the hon. secretary, Mr. S. T. Needham, 10, York Place, Leeds (5s. 9d. each, single). The annual general meeting of the Club was held on November 14th: the balance sheet showed a profit for the year of £13.

Catalogues Wanted.

The RED SPOT CO., 192, Coventry Road, Small Heath, Birmingham, who are commencing business as retailers of electrical goods and electrical and radio contractors, ask for catalogues in connection with these lines.

Messrs. LONGHURST & MOORE, St. Michael's Garage, Sunninghill, Ascot, who have commenced an electrical contractors' business, also ask for catalogues.

Battery Manufacture in Australia.

The *Australasian Electrical Times* reports that, following on a visit to the Commonwealth of a representative of the Dutch firm of Heberholds, battery manufacturers, arrangements have been made for the establishment in Melbourne of a factory for the production of all classes of dry batteries. During the past few years the Dutch company has exported large quantities of batteries to Australia, but owing to the recent tariff these exports have ceased. The new factory will employ between 50 and 100 people at the start; the capital will be Australian and, so far as possible, all raw material used will be of Australian origin.

The British Industries Fair.

The Board of Management of the Birmingham section of the Fair is assisting salesmanship by bringing the importance of the 1931 Hardware and Machinery Section to the notice of trade buyers in the Dominions and foreign markets. An impressive broadsheet in pictures, depicting the remarkable variety of engineering products to be seen in Birmingham next spring, has been issued in most countries abroad, with text in the appropriate language, outlining the chief groups of exhibits and reasons why buyers from everywhere should "Come to Birmingham." Nine editions have been distributed by British Consuls and agencies in the following languages: English, German, Swedish, French, Spanish, Dutch, Portuguese, Italian, and Danish.

Italy's Foreign Electrical Trade.

The recently published official returns show that the imports of electrical machinery, apparatus and fittings into Italy during the eight months ended with August last attained a value of £2,589,740, as compared with £2,467,310 in the corresponding eight months of 1929. The exports of similar material of Italian manufacture during the same period declined, however, from £623,490 to £622,930.

Patent Application.

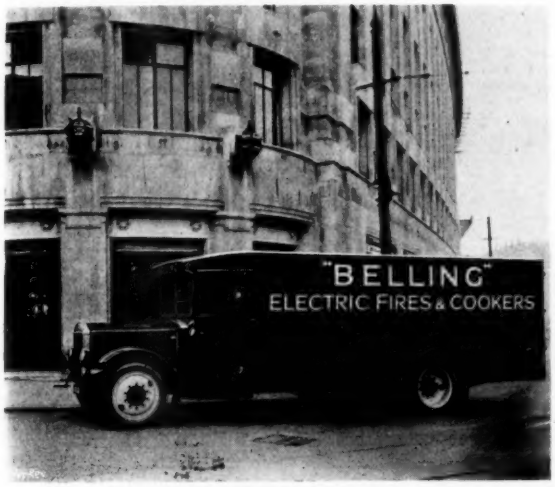
The Hazeltine Corporation, Jersey City, U.S.A., has applied for leave to amend its application for letters patent No. 312,354, relating to an invention entitled "Wireless Signalling System." Particulars of the amendment appeared in the Patent Office *Journal* of November 19th. Opposition to the application has to be entered within one month of that date.

The Radio Apparatus Market in Jugo-Slavia.

A confidential report on the market for radio apparatus in Jugo-Slavia has been prepared by the Department of Overseas Trade from information furnished by the Commercial Secretary, Belgrade. United Kingdom firms desirous of receiving a copy of this report, together with particulars of the Special Register service of information and form of application for registration, should communicate with the Department, 35, Old Queen Street, S.W.1, quoting reference B.X. 6874.

A Large Belling Delivery Van.

The accompanying illustration shows the latest addition to Belling & Co.'s fleet of delivery vans. It is a 3-ton Albion van, capable of carrying 500 fires, and is one of the largest delivery vans on the road, being 26 ft. 9 in. long and 7 ft. 6 in. wide. It



A Belling Delivery Van.

is used for delivering "Belling" electric fires, cookers, &c., to the provincial depôts at Birmingham, Bristol, Glasgow, Leeds, Manchester and Newcastle. The photograph was taken recently outside Carliol House, the headquarters of the Newcastle-upon-Tyne Electric Supply Co., Ltd.

Wages in the Cable-making Industry.

We are informed by the Joint Industrial Council for the Electrical Cable Making Industry that there will be no "cost-of-living" alteration in wages on the third pay-day in December.

Victorian Electricity Commission's New Building.

A new building is to be erected in Melbourne to house the Victorian Electricity Commission. Some time ago the Commission bought the existing building for £210,000, of which £135,000 has been paid. The Commission is acquiring the Melbourne Electric Supply Company's undertaking, and under the agreement the company has agreed to take over the building, reconstruct it, and lease it to the Commission for five years, when it will be repurchased by the Commission. A large part of the premises will be used for show and demonstration rooms, and that part of the remainder which is not required for offices will be let. The new building will have eleven storeys and will take a year to complete.

The Closing of the Dick, Kerr Works.

Our local correspondent states that Mr. G. H. Nelson, managing director of the English Electric Co., Ltd., paid a visit on November 19th to the Dick, Kerr works, Preston, where the engineering department is being closed down, to meet the employés. He is understood to have offered positions to several of the staff at the Bradford works and other centres, while others were informed that their services would not be required after certain dates.

The Marking of Imported Compressors.

On Monday last the Standing Committee of the Board of Trade under the Merchandise Marks Act commenced the hearing of an application for an Order-in-Council requiring the marking with an indication of their origin of imported air and gas compressors, exhausters, pneumatic tools and appliances. The application was made by the British Compressed Air Society and opposition was entered by ten concerns manufacturing and dealing in these appliances.

The Buenos Aires Exhibition.

In addition to those companies mentioned in our last issue as exhibitors at the forthcoming British Empire Trade Exhibition, Buenos Aires, Messrs. Thomas de la Rue & Co., Ltd., are preparing a display.

A Trade Representative for Jamaica.

A branch office of His Majesty's Trade Commissioner's Office in the British West Indies will be opened in Jamaica early in the New Year. Mr. Massie-Blomfield, M.A., has been appointed to take charge of the new office, and will be available at the Department of Overseas Trade from December 8th to 10th to interview British firms interested in trade with Jamaica and British Honduras.

Siemens Bros. and an Austrian Company.

The announcement is made that the negotiations between Viennese financial establishments and Siemens Bros. & Co., Ltd., for the sale to the latter of the shares held by the former in the "Elin" (Electrical Industry Company) have been broken off at the instance of the Minister of Commerce. It would thus appear that the activities of the "Elin" are to be continued on a normal footing. It is reported that a London banking firm played a part in the negotiations.—*Reuter* (Vienna).

Rectifier Plant for Sheffield.

According to *The Times Trade and Engineering Supplement*, the Sheffield Electric Supply Committee has instructed its general manager to visit certain works on the Continent, where plant ordered by the Committee is under construction, and to inspect some power stations where boiler equipment and appliances of the most modern type have been installed. The countries to be visited are Switzerland, France, and Belgium. The plant ordered on the Continent consists of three 500-kW automatic steel-clad rectifiers for three new substations for tramway supplies, and the amount involved is about £9,000.

New Showrooms and Offices at Brentwood.

New electrical showrooms and offices have recently been opened by the Brentwood District Installations, Ltd., in conjunction with their associated company, the Brentwood District Electric Co., Ltd., in High Street, Brentwood. They have been built in a prominent position and replace the premises in Ongar Road, which for some time have been found quite inadequate to cope with the volume of electrical business consequent on the increased population and the growing roll of new consumers. The show windows are lighted by "Gecoray" reflectors, while the initial displays

New Showrooms at Brentwood.

demonstrate on one side "Magnet" cookers and fires, and on the other the full range of "Magnet" electrical appliances for the home, with a large assortment of electric light pendant fittings, wall brackets, and standard lamps supplied by the General Electric Co., Ltd. The showrooms include a lounge, a kitchen well adapted for demonstration at any moment, and a large general showroom for the display of a wide range of modern electric lighting fittings in glass and metalware, and various labour-saving appliances for domestic use. An exterior night view of the showrooms appears in the accompanying illustration.

D

Trade Openings in Canada.

In the course of a recent interview with a representative of the *Chamber of Commerce Journal*, Mr. F. W. Field, Senior Trade Commissioner in Canada, said that, although the Dominion was suffering from trade depression, its position was probably better than that of the majority of markets. There was still a good deal of activity in mining, building construction, certain manufacturing industries, and water-power development. Among the classes of United Kingdom goods which were finding favour in Canada, Mr. Field mentioned electrical machinery. With an adequate organisation in Canada it should be possible, he said, to sell quantities of many kinds of machinery for use in factories. "There seems to be no good reason why a group of six or eight non-competitive firms making what might be termed the machinery of production, should not combine for selling purposes in Canada. This would place them on an equal footing with their competitors in the United States. Stocks could be carried, good delivery and service could be given, and repairs effected at short notice."

Employment during October.

The November *Ministry of Labour Gazette* states that during October employment in the engineering industry remained bad, and showed a further decline in all sections with the exception of motor vehicle manufacture. In the electrical section, employment was "very moderate." Compared with a year ago, employment was much worse in all sections and in all areas. In the engineering industry, as a whole, the number of unemployed rose to 197,154, representing an increase from 18.2 to 19.4 in the total. In the electrical section the number of unemployed was 9,098, an increase from 8.5 to 9.3 per cent. On the other hand, there were improvements in the two other electrical sections. The cable, wire and lamp manufacturing group recorded a fall to 9,993 in the number of unemployed, the proportion declining from 9.9 to 9.7 per cent. For the fourth consecutive month, unemployment in the electrical wiring and contracting section was lower, at 1,832, representing a decline from 10.2 to 9.9 per cent. The foregoing percentages are based on the revised figures for July. The number of insured persons in the industries with which we deal were as follows at the beginning of July:—Engineering, 1,016,240, including electrical engineering, 89,860 (females 20,180); electric cable, wire and lamp manufacture, 102,620 (females 40,530); and electrical wiring and contracting, 18,510 (females 1,360).

The Illumination of Weymouth Bridge.

Special fittings were required for the illumination of Weymouth Bridge, which was recently opened by the Duke of York, and for this purpose six lantern pillars were supplied by Messrs. Falk, Stadelmann & Co., Ltd. These are made of cast and wrought iron, with ¾-in. plate glass, satin finished,

Lantern Pillars on Weymouth Bridge.

with bright bevels, one side of the lantern being arranged as a door; also with two bronze grilles made of solid drawn bronze metal work. The company also supplied electric stop signs of the bull's-eye type for partially illuminating the bridge, and tablets suitable for inscription. Two of the lantern pillars are shown in the accompanying illustration.

Unemployment.

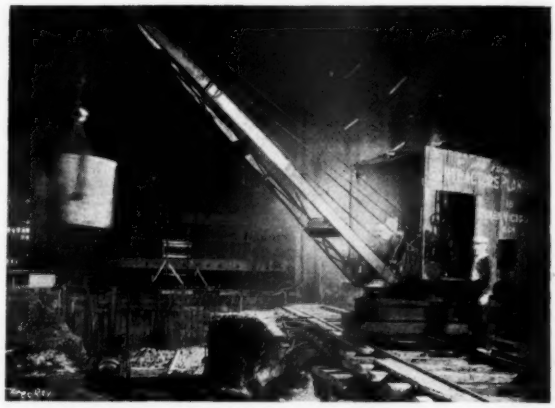
There was a slight decrease (1,350) in the number of registered unemployed during the week ended November 10th. On that date the total was 2,261,777, as compared with 2,263,127 on November 3rd and 1,259,134 on November 11th, 1929.

The ex-B.W. Association.

The latest issue of "Inter Nos," a publication of "variable frequency," which is the organ of the ex-British Westinghouse Association, contains, in addition to the usual persuasive appeals for subscriptions, a report of the last annual dinner and a list of those present. There are also three "poems" and some personal notes. The hon. secretary is Mr. L. S. Richardson, 70, Preston Road, Wembley Park, Middlesex.

Rebuilding a Wharf by Floodlight.

The work of rebuilding Hays Wharf, Tooley Street, S.E., is proceeding rapidly and night work is made possible by the use of floodlights supplied by Philips Lamps, Ltd. The accompanying illustration is one of several taken under artificial light,



Reconstruction Work by Floodlight.

and is typical of the results achieved in various positions and sections of the job. It shows how valuable this form of lighting is for building construction work. The floodlights used were Philips type F.L.A. with 1,000-watt gasfilled lamps.

Budgetary Control.

The Business Research and Management Association of Great Britain has decided upon an intensive investigation of budgetary control from its many angles, and several meetings of the current session of the Association are to be devoted to it. The first of these takes place on December 3rd, when Mr. A. Parker is to read a paper on "Budgetary Control in a Small Business," and individual members will discuss specific problems from their own points of view. The meetings of the Association are held at Anderton's Hotel, Fleet Street, E.C., at 7 p.m., and interested people are invited to attend them. The secretary is Mr. H. A. Hazlitt, 27, Chancery Lane, W.C.2.

New Australian Companies.

The following companies have recently been registered in Australia:—National Accumulator Co., Ltd., Melbourne and Sydney (head office in England), formed with a capital of £350,000 to acquire a controlling interest in the D.P. Battery Co., Ltd., and Hart Accumulator Co., Ltd., to deal in cables and to carry on business as electricians. Speakers (Australasia), Ltd., Melbourne, formed with a capital of £10,000 to purchase from Amplion (Australasia), Ltd., certain stocks of wireless goods and to carry on business as electricians' suppliers and manufacturers of generators and accumulators, &c.

French Cable Works Extension.

The Société Electro-Câble reports that the first stage of extensions at the Argenteuil works has been completed and that the new telephone cable factory will probably be brought into operation at the beginning of next year.

Bankruptcy Proceedings.

The MARQUESS OF WINCHESTER, 1, Portland Place, W.1.—The first meeting of creditors was held at Carey Street, W.C.2, on November 19th. Mr. F. Vyvyan, Official Receiver, stated that it appeared that the debtor was associated with Clarence Hatry and had acted as chairman of some of the 43 companies located at Pinners Hall, E.C. His failure was attributed to liabilities incurred on behalf of the Austin Friars Trust, one of the companies controlled by Hatry. A statement of affairs presented showed total liabilities of £462,182, of which £268,667 was expected to rank for dividend, and assets of £1,026, which were absorbed by preferential claims. Messrs. K. A. Layton Bennett and W. J. Albery were appointed joint trustees to administer the estate in bankruptcy.

A. G. L. PENNOCK, 59, Primrose Hill Street, Coventry, Warwickshire, radio and electrical dealer.—The receiving order herein was made on October 16th on a creditor's petition. The first meeting of creditors was held recently at the Official

Receiver's office, 9-11, High Street, Coventry. The following are creditors :—

	£		£
Gothic Electrical Supplies, Ltd.	413	Newton, G.	109
Hanson, F. E., Ltd. ...	69	Shiers, D.	70
Bankers	98	Philips Lamps, Ltd. (contingent liability) ...	31

V. R. SHEWAN and A. L. GRACE, trading as the Avon Radio Manufacturing Co., Long Ashton, Somerset, radio manufacturers.—The first meeting of creditors was held on November 19th at the Official Receiver's offices, 26, Baldwin Street, Bristol. The statement of affairs showed liabilities of £576, with assets of £105, leaving a deficiency of £471. It was reported that during the first year of trading the net profit had been about £5, and during 1929 it was £103. The debtors attributed their failure to bad trade, liability to pay £84 on account of excess royalties on radio sets, want of capital, and bad debts. The case, being a summary one, was left in the hands of the Official Receiver as trustee.

R. S. ESP, electrician, 2, Green Lane, Bilston.—Receiving order made November 13th, on debtor's own petition. First meeting November 27th at the County Court offices, 50, Queen Street, Wolverhampton. Public examination December 8th at the County Court, Wolverhampton.

J. M. WALSH, electrical engineer, 33, Villiers Street, Strand, W.C.—Application for discharge to be heard on December 9th at Bankruptcy Buildings, Carey Street, W.C.2.

J. W. WHITE, radio and electrical engineer, 32, Castledore Road, Parkstone, Dorset.—First meeting December 2nd, and public examination, December 5th, both at the Law Courts, Stafford Road, Bournemouth.

R. J. IRVING, wireless dealer, 4, Bridge Road, Kirkstall.—Last day for receiving proofs for dividend, December 10th. Trustee: Mr. H. C. Bowling, 24, Lower Bond Street, Leeds, Official Receiver.

D. J. DAVIES, wireless engineer, 36, Cambrian Street, Aberystwyth.—First and final dividend of 3s. 8d. in the £, payable November 28th at 4, Queen Street, Carmarthen.

J. G. WADSWORTH, electrical engineer, &c., 10, Westfield Terrace, Higham Ferrers.—First and final dividend of 4d. in the £, payable November 28th at the Official Receiver's office, 6, The Parade, Northampton.

J. C. K. BIRKETT, wireless dealer, 1, Scotland Road, Carnforth.—First and final dividend of 2s. 7d. in the £, payable November 26th at the Official Receiver's offices, 9, Cannon Street, Preston.

Company Liquidations.

ASSOCIATED WIRELESS CO., LTD., 15, Miller Street, Camden Town, N.W.—Under a winding up order made against this company on October 20th on the petition of a creditor, the statutory meetings of the creditors and of the shareholders were held on November 19th at Carey Street, W.C. Mr. Naunton, Assistant Official Receiver, reported that the company was promoted by Mark Bolsom, the late managing director, and was registered on September 14th of last year with a nominal capital of £500, afterwards increased to £1,000. Its objects were, *inter alia*, to carry on the business of wholesale and retail radio instrument makers but its immediate object was to acquire from Bolsom the goodwill of the business of a dealer in radio sets. The sale price of the business to the company was fixed at £750, of which £150 still remained unpaid. On April 7th last Bolsom applied for and was allotted 600 shares which appeared to have been paid for by an exchange of cheques, the £600 paid by the company being in part payment of the purchase price. A lease of factory premises was taken by Bolsom at £150 a year and he sublet them to the company for three years at £300 a year. To meet pressing liabilities £350 was borrowed from Mrs. Bolsom, who was secretary, and there was issued to her a debenture for that amount charging the company's assets. That was in May last and eventually Mr. W. A. J. Osborne, accountant, took possession of the assets as receiver for the debenture holder. Bolsom attributed the company's failure to depression in trade, to the retention of the staff during the slack season, and to alleged pilfering of stock. According to the statement of affairs filed in the liquidation the total of the liabilities was £3,800, of which £3,150 were expected to rank, and the gross amount of the assets was £1,764. The latter, however, were subject to a deduction of £300 in respect of preferential payments and a further reduction of £350 in respect of the debenture holder's claim, and a deficiency of £2,035 was accordingly disclosed with regard to the creditors. In relation to the shareholders there was a total deficiency of £2,637. The liquidation was left in the hands of the Official Receiver.

INTERNATIONAL ELECTRIC CO., LTD., 20, Essex Street, W.C.2., and Ashley Road, N.17.—A meeting of creditors was held last week at the Holborn Restaurant, W.C.2. No statement of affairs was presented, but from a balance sheet prepared to November 30th, 1929, the liabilities consisted of debentures, £93,866; unsecured loan to the bank, £55,244; other unsecured liabilities, £44,000; while fully-secured creditors amounted to £9,765. The assets comprised stock £25,000; plant, machinery, and tools, £24,000; furniture and fixtures, £3,000; freehold land and buildings, £38,500; and goodwill, £3,000. Mr. Fraser Ure, accountant, who had been appointed liquidator by the shareholders at a previous meeting, stated that although the creditors had granted the company a moratorium, the directors had not been able successfully to conclude negotiations which had been going on for some time for the reconstruction of the company. The whole of the assets would, in the near future be realised for auction, but the amount received thereby would be insufficient to even meet the debenture holders' claim. It was understood, however, that certain principals connected with the company would pay the creditors a composition of 2s. in the £ on their claims. It was resolved that Mr. Fraser Ure's appointment as liquidator should be confirmed.

STEWART THOMSON & PATRICK, LTD., Liverpool.—A meeting of members has been convened to consider resolutions for voluntary liquidation and the appointment of Mr. E. K. Williams, 30, North John Street, Liverpool, as liquidator. A meeting of creditors is to be held on December 4th at Mr. Williams's offices.

RADIELLE CO., LTD.—Meetings of creditors and members will be held on December 18th at the offices of Messrs. William S. Ogle, Sons & Porter, 2, Austin Friars, E.C.2, to receive an account of the winding up of the company by the liquidator, Mr. F. J. Parsons.

AD-SHADES, LTD.—A meeting of members is to be held on December 29th at the offices of Messrs. Newland, Leech and Co., Empire House, 159, Great Charles Street, Birmingham, to receive an account of the winding up of the company by the liquidator, Mr. R. V. Newland.

KNOWSLEY ELECTRICAL CO., LTD.—A meeting of members is to be held at the offices of the liquidator, 43, Castle Street, Liverpool, on December 22nd, to receive the report on the winding up of the company by the liquidator, Mr. T. Robson.

NEON LIGHTS (1928), LTD.—Winding up voluntarily. Liquidator: Mr. G. S. Groundwater, St. Lawrence House, Trump Street, King Street, E.C.2.

BOROUGHBRIDGE AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Winding up voluntarily. Liquidator: Mr. C. E. Winder, "Ureville," Boroughbridge.

L. H. M. ENGINEERING CO., LTD.—Winding up voluntarily. Liquidator: Mr. F. A. Pratley, 6, Bishopsgate, E.C.2. Particulars of claims to the liquidator by January 2nd.

WORK METERS, LTD.—Particulars of claims to the liquidator, Mr. W. Thompson, 21, Henry Street, Keighley, by December 31st.

Price Reductions.

The MARCONIPHONE CO., LTD., announces reductions in the price of its "Model 56" receiver.

Messrs. L. G. HAWKINS & CO., LTD., have reduced the price of their "Peter-the-Heater" device for car heating.

New Catalogues and Lists.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Vol. II of the B.I. general catalogue. In this excellently-produced publication is given a most comprehensive list of the company's products, which include overhead-line materials for power, telephone, and traction purposes, welders and rivet heaters, fuse boxes and switch-fuses, ceiling fans, varnishes, paper pinions, wires, and cables. The volume, which is bound in a stiff cloth cover, is well illustrated, and though so comprehensive, is not too bulky for convenient reference. An easily-read visual index is incorporated.

GEORGE GREEN & CO., "Gee-Gee" Works, Chapel Road, West Norwood, London, S.E.27.—A leaflet describing the latest addition to the company's range of immersion water heaters.

E. K. COLE, LTD., Ekco Works, Southend-on-Sea.—A folder issued in connection with the company's "fifty-fifty" advertising scheme which will be in operation until December 24th. Under this scheme blocks are loaned to dealers in "Ekco" apparatus and half the cost of their advertising paid.

The DRAYTON REGULATOR AND INSTRUMENT CO., LTD., West Drayton, Middlesex.—An illustrated list of the company's wide range of automatic regulators and control instruments.

REVO ELECTRIC CO., LTD., Britannia Works, Tividale, Tipton, Staffs.—A well-illustrated catalogue giving details of the latest types of "Revo" cooking apparatus.

NATHAN & ALLEN, LTD., 131, Victoria Street, London, S.W.1.—A revised list (46 Ce), giving reduced prices and additional information concerning small hand-wound time switches.

MARRYAT & PLACE, 40, Hatton Garden, London, E.C.1.—A booklet entitled "How is it Done?" describing how Messrs. Marryat & Place undertake to maintain, insure, and keep electrical plant and lifts running at less expense than a firm's own staff.

CROMPTON PARKINSON, LTD., Guiseley, Leeds.—A brochure (No. A 401) illustrating and describing the company's rotary convertors.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, London, W.C.2.—The "Radio Dealer's Handbook," giving the technical particulars of Philips receivers, loud-speakers and h.t. units, with hints on showroom and shop-window dressing, local newspaper and direct mail advertising, demonstration and part-exchange trading.

PAUL DIENY, 317, High Holborn, London, W.C.1.—A leaflet, illustrating and describing fractional h.p. universal electric motors for sewing machines, &c., and also universal electric exhaust and blowing fans.

The SOLENOID REGULATOR CO., 268, Moseley Road, Birmingham.—An illustrated and priced list of d.c. automatic motor starters.

The ISOLA MANUFACTURING CO., Shepley Street Works, London Road, Manchester.—A leaflet showing results of tests made upon "Isola" black adhesive tape.

DRAKE & GORHAM WHOLESALE, LTD., 77, Long Acre, London, W.C.2.—Pamphlet No. 485, a comprehensive catalogue of radio sets, radio-gramophones, eliminators, batteries, loud-speakers, and other radio apparatus. The publication is clearly set out and well illustrated, and has a most attractive cover.

W. C. DAVEY & Co., 27-29, Mortimer Street, W.C.1.—A handy-sized telephone wall card.

CUTHBERT ANDREWS, 47, Red Lion Square, London, W.C.1.—A card indicating the merits of the "Protexray" tube.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.—A pamphlet (F. and C. 5679), describing the Fraser & Chalmers pulverised fuel system for firing Lancashire boilers and metallurgical furnaces.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, London, E.C.1.—The second edition of the company's overhead transmission catalogue contains over 200 pages dealing with all branches of the subject. Sections are devoted to overhead line costs, technical information, wood and steel poles, lattice towers, guardings, street lighting fittings, insulators, switchgear and protective equipment, official regulations and specifications, as well as to descriptions of the overhead systems of various undertakings. The publication is well bound and contains innumerable illustrations, and should prove a useful work of reference.

Recent Contracts.

The GENERAL ELECTRIC CO., LTD., has received from the London Underground Railways Co. an important order for the supply of some 300 heavy traction motors for the new rolling stock required in connection with the Cockfosters and Hounslow extensions of the "Underground" system. This order constitutes the ninth successive order for electric traction equipment received by the G.E.C. from the London "Underground" in the past few years, and when completed it will bring the total of modern heavy railway motors of G.E.C. manufacture in use on the "Underground" to nearly 2,000. The General Electric Co. has also received, through the Birmingham Railway Carriage and Wagon Co., Ltd., the order for the complete electrical equipment of 61 new compartment-type coaches now being constructed to the order of the Metropolitan Railway Co. The material to be supplied comprises electric traction, lighting, and heating equipment for 14 four-motor motor coaches, 14 driving trailer coaches, and 33 trailer coaches. The motor coaches will each be equipped with four self-ventilated motors rated at 275 b.h.p. on the one-hour rating. The control gear will be of the electro-pneumatic type.

Two important orders have recently been received by the ENGLISH ELECTRIC CO., LTD. The first is in connection with the Lanarkshire hydro-electric scheme, and covers the conversion from 25 cycles to 50 cycles of the main generating units at the Bonnington and Stonebyres power stations. These water turbine-alternator sets, two of 7,000-h.p. at Bonnington, and two of 4,000-h.p. at Stonebyres, together with the complete hydro-electric auxiliaries, were supplied by the English Electric Co. The conversion of one set at Bonnington has already been carried out, the stators of the alternators are being rewound at site, while the rotors will be returned to the Stafford works for conversion from 8 to 16 poles. The Bonnington set was converted within the short space of ten weeks.

The other order is from the Buenos Aires Great Southern Railway, and is connected with Diesel-electric traction. The new stock for the railway will include three eight-coach trains, each train having attached to it a self-propelling Diesel-electric power house. For this stock the English Electric Co. will supply 62 motors, each of 135 h.p., and control equipments. Two motors will be mounted on each of the outer bogies of the power houses, and each motor coach will be driven by two motors, leaving two motors spare. The company is also supplying six motors and control equipments for a 1,700-h.p. high-speed Diesel-electric locomotive which is under construction. The main contractors for the rolling stock are Messrs. Armstrong Whitworth, who will also manufacture the Diesel engines.

The Electricity Supply Commission of Johannesburg has placed an order for the supply of new boiler plant in connection with the installation of further electrical generating equipment at the Congella power station, Durban. The contract for the steam-raising plant has again been placed with INTERNATIONAL COMBUSTION, LTD. The equipment comprises two of the company's standard combustion steam generators of 100/120,000 lb. per hour evaporation at 270 lb. per sq. in. pressure and 700 deg. F. final temperature, complete with "Lopulco" pulverised-fuel firing equipment. This is the fifth contract for pulverised-fuel-fired boiler plant secured by International Combustion, Ltd., in South Africa this year.

The MARCONI INTERNATIONAL MARINE COMMUNICATION CO., LTD., is installing wireless equipment, including a direction finder and an auto-alarm, on the new Booth liner *Hilary* now building at Birkenhead. The valve transmitter for interrupted-continuous-wave telegraphy will operate on wavelengths between 600 and 800 metres with a power of 1½ kilowatts. The receiver will be fitted with a rejector circuit covering the wavelength range of 15 to 20,000 metres.

Book Notices.

"Pension and Superannuation Funds," by Bernard Robertson and H. Samuels. Second edition (148 pp.). London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.—The additions in this second edition include a draft set of rules for a superannuation scheme run through a life assurance company, and a description of a comprehensive scheme of pensions offered by such a company.

"The Profession of Science," by Sir Richard Gregory, Prof. Julian Huxley, and others. Pp. vii+16. London: Association of Scientific Workers.—A booklet which urges the claims of the Association.

We have received from the McGraw-Hill Publishing Co., Ltd., London, a revised edition of the company's sectional catalogue (List 2), which gives particulars and brief reviews of books on all branches of electrical engineering, including general theory, measurements, problems, electrical machine design, electric motors, illumination, wiring, contracting and equipment, power transmission, and power plants. It contains 52 pages and has indexes both to subjects and to authors.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Nov. 25th	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5½d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£17	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... . per lb.	3d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3½d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£85 to £90	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net.	£118	£1 inc.
	Grade II ... ... ,, ,,	£82	£2 dec.
	Grade III ... ... ,, ,,	£50	£1 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	8½d.	½d. inc.
c	,, Tubes (solid drawn) ... ,,	10½d. to 10⅝d.	¼d. inc.
c	,, Wire, basis ... ... ,,	9d.	1d. inc.
c	Copper Tubes (solid drawn) ... ,,	1/-	1d. inc.
g	,, Bars (best selected) ... per ton	£84	
g	,, Sheet ... ... ,,	£84	£11 inc.
g	,, Rod ... ... ,,	£84	
d	,, (Electrolytic) Bars ... ,,	£56 15s.	£10 10s. inc.
d	,, ,, Sheets ... ,,	£143 10s.	
d	,, ,, Wire Rods ... ,,	£66 15s.	£10 10s. inc.
d	,, ,, H.C. Wire per lb.	8½d.	1⅛d. inc.
f	Ebonite Rod ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/1	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	6½d.	¾d. inc.
i	Iron, Pig (Cleveland No. 3.) ... per ton.	75/6	12s. inc.
	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£17 10s.	10s. inc.
g	Mercury ... ... per bot.	£22 10s. to £22 12s. 6d.	...
e	Mica (in original cases) small ... per lb.	6d. to 8/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/1½d.	...
p	,, ,, drawn bars & rods ,,	1/1½d.	¾d. inc
p	,, ,, rolled strip & sheet ,,	1/1½d.	¾d. inc.
p	,, ,, wire ... ... ,,	1/2d.	1½d. inc.
o	Platinum ... ... per oz.	£7	...
d	Silicium Bronze Wire ... ... per lb.	9½d.	½d. dec
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£115 10s. to £116 10s.	£2 15s. inc.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	2/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a	G. Boor & Co.	*g*	James & Shakespeare.
b	The British Aluminium Co., Ltd.	*h*	Edward Till & Co.
c	Thos. Bolton & Sons, Ltd.	*i*	Bolling & Lowe.
d	Frederick Smith & Co.	*l*	Richard Johnson & Nephew, Ltd.
e	F. Wiggins & Sons.	*n*	P. Ormiston & Sons.
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	*o*	Johnson, Matthey & Co., Ltd.
		p	C. Clifford & Son, Ltd.
		r	W. F. Dennis & Co.

Messrs. James Forster & Co., in their letter dated November 22nd, state that the lead market opened slightly firmer last week, prices advancing a further 2s. 6d. a ton, but Tuesday saw a severe reaction of 20s. a ton. Wednesday's market was again rather firmer but on Thursday and Friday a fresh decline set in and prices closed at very little above the level of a fortnight ago. This proves that there was no justification for the rise, apart from sentiment, trade conditions if anything being rather worse than they were a month ago. "We cannot see anything in present conditions to justify a sustained advance in lead but rather look for a gradual decline to a lower level."

Social Events.

The Union Cable Company's football team went to Manchester to play the first round tie with W. T. Glover & Co.'s team at Trafford Park on November 22nd. The team was accompanied by Mr. J. Snow Huddleston, general manager of the company and president of the Club. The Union team, after a game which was full of thrills, won by four goals to nil, but Glovers were somewhat unlucky to lose by so many goals. After the game both teams were entertained at dinner in the works canteen and later were taken to the Manchester Hippodrome by the management of Messrs. W. T. Glover and Co., Ltd., through the efforts of Major Chandler, managing director.

The Dramatic and Musical Section of the Callender Athletic and Social Club (London) gave a performance of "9.45" (a comedy-melodrama by Owen Davis and Sewell Collins), at the King George's Hall, W.C., on November 18th. The whole performance had the finish of much experience, and considerable credit is due to the producer, Miss E. Goole. Special mention should also be made of Mr. S. Graefe as "Inspector Dixon," and Mr. W. A. Dickson as "Clayton," who carried the success of the evening on their shoulders. Among the large and representative audience were seen Lady T. O. Callender (Sir T. O. Callender was prevented from attending by indisposition), Messrs. T. Petersen and Howard Foulds.

The netball and rowing sections of the G.E.C. Social Club held a successful dance at Magnet House on November 7th. There was an excellent attendance, due largely to the hard work put in by the organisers, Miss Cox and Mr. Pugh.

The Nelson Electric Co., Ltd.

The receiver for the debenture holders of this company, Mr. G. H. Robinson, 95a, Chancery Lane, W.C.2, states that, subject to the recovery of certain doubtful book debts, he has completed the realisation of the company's assets. As a result, the debenture holders will receive only a few shillings in the pound on their claims, and consequently there will be nothing for the unsecured creditors or shareholders.

For Sale.

Nelson Electricity Department has for disposal a large number of d.c. meters, and also a quantity of scrap copper and lead.

The London County Council invites tenders for the purchase, dismantling, and removal of boilers, economisers, and feed pumps at present installed in the tramway power station at East Greenwich.

Messrs. Fuller, Horsey, Sons & Cassell offer for sale the freehold factory, plant, and machinery of the International Electric Co., Ltd.

(See our advertisement pages to-day.)

Lighting and Power Notes.

Australia.—VICTORIAN STATE ELECTRICITY SCHEMES.—According to the *Australian Electrical Times*, the State electricity schemes of Victoria have now an installed capacity of 157,000 kW, and have cost £6,580,638 for the necessary plant. The details are: Yallourn, 50,000 kW, £2,513,447; addition of sixth turbo set to Yallourn, 12,500 kW, £77,156; second section of Yallourn, 50,000 kW, £2,200,000; Newport "B" station, 18,000 kW, £774,933; Sugarloaf hydro-electric system, 11,500 kW, £871,006; Richmond power station, 15,000 kW, £144,096. The last two items represent an extreme example of the greater capital cost per kW installed of hydro-electric, as compared with thermal schemes.

CABLES UNDER BRISBANE RIVER.—The ring-main system which serves North and South Brisbane from the Greater Brisbane Council's electric supply system was completed recently by the laying of two cables under the river from Bouquet St., S. Brisbane, to a point opposite Boomerang St.

Beccles.—REVISED CHARGES.—The East Anglian Electric Supply Co., Ltd., has introduced the following new two-part tariffs:—(*a*) Private residences: Not exceeding 700 sq. ft. floor area, a fixed charge of £3 per annum, each additional 100 sq. ft. up to 1,600 sq. ft. being charged at 10s., and each 100 sq. ft. over 1,600 sq. ft. at 7s.; 40 kWh of electricity is included for each £1 of the fixed charge, energy consumed in excess of the quantity allowed being charged at 1½d. per kWh. (*b*) Shop and business premises: A fixed charge of £15 per annum per kilowatt of lamps installed, plus 1½d. per kWh consumed, subject to a minimum fixed charge of £6 per annum.

Blackpool.—COST OF AUTUMN ILLUMINATIONS.—The net cost of Blackpool's autumn illuminations was £11,418, or £582 below the estimate.

Chippenham.—HOUSE WIRING SCHEME.—The Town Council has accepted the offer of the West Wilts Electric Light and Power Co., Ltd., to carry out free of cost the wiring of new houses during construction and to fix three lights, subject to the tenants entering into an agreement to pay £3 per annum by weekly or monthly instalments. For this amount they will be entitled to use up to 120 kWh per annum, energy in excess of this amount being charged at 3d. per kWh.

Continental.—JUGO-SLAVIA.—The Belgrade correspondent of the *Financial News* states that a large plan for the electrification of the whole of Central Serbia, the Shumadia district, is to be financed by Austrian capital, through the Niederösterreichische Escompte-Gesellschaft. This plan is the result of the extension of the activities of the "Jelica" Co., at Cacak, which is now preparing to exploit the water-power of both the Morava and Studenica Rivers, and is to erect a hydro-electric station of 7,000 h.p. for this purpose. The works to be executed are to cost about 100,000,000 dinars (£360,000). This marks the first entry of Austrian capital into the Jugo-Slav electrical industry. Hitherto, the foreign capital in this industry has been mainly French, Swedish, and Swiss, while American capital has participated to a lesser extent. There is still very large scope for foreign capital in this industry; firstly, because only 250,000 h.p. out of a possible total of 3,500,000 h.p. with a minimum level of water is being exploited; and secondly, because municipalities and autonomous local bodies are most anxious to grant electrical concessions and attract foreign capital.

FINLAND.—In a recent issue of *Wasserkraft und Wasserwirthschaft* Herr B. Sjogren gives some details of the low-head (from 10 ft. to 17¼ ft.) hydro-electric power station recently completed at Myllykoshi. The plant is used partly to drive the machinery in an adjacent timber-preparing factory and partly for the generation of electricity. The timber plant comprises four 1,100-h.p., Francis-type, horizontal-shaft turbines running at 79 r.p.m. For power generating purposes a Kaplan vertical-shaft turbine of 3,800 h.p. running at 94 r.p.m. is directly-coupled to a 5,700-kVA generator.

RUSSIA.—The State Peat Trust has completed a plan for the construction, near Tver, of a large power and industrial combine uniting forty-one industries. A generating station having a capacity of 421,000 kW is to be constructed and it will use peat fuel, which can be obtained from the vast local marshes. The construction of the combine will cost 1,000 million roubles. —*Reuter's Trade Service* (Moscow).

Croydon.—RURAL SUPPLY.—A conference was held recently at Croydon at which representatives of Croydon Corporation and the Urban District Councils of Coulsdon, Mitcham, Beddington and Merton discussed the question of the purchase rights under the Croydon Rural Electric Lighting Order, 1905. It was agreed that the local authorities for the area of supply under the Croydon Rural Electric Lighting Order, 1905, *viz.*, the parishes of Addington, Beddington, Coulsdon, Mitcham, Morden, Sanderstead and Woodmansterne should be recommended to seek the decision of the Court on the question of the rights of purchase under the Order, and that the cost of the proceedings should be shared in proportion to the rateable values of the areas included in the Order, each local authority paying not less than one-tenth of the total cost. If the whole of the local authorities agree to these recommendations, a further conference is to be convened to discuss the steps to be taken.

MAINS EXTENSION.—The Corporation Electricity Committee is to apply for sanction to a loan of £50,000 for mains extensions.

TRANSFORMING STATION FOR C.E.B.—The Central Electricity Board is to erect a transforming station off Factory Lane.

Dartford.—HOSPITAL LIGHTING.—The Central Public Health Committee of the London County Council recommends the conversion of the lighting of Orchard Hospital, Dartford, from gas to electricity.

Dumfries.—CHANGE-OVER.—At a recent meeting of the Town Council a letter was read from the Electricity Commissioners intimating approval of the Council's application for consent to change-over the system of supply from d.c. to a.c. The Council decided to apply for sanction to the borrowing of £1,000 to meet the cost of the change-over.

Dundee.—EXTENSIONS.—Under an arrangement between Birkhill Local Committee and the Grampian Electricity Supply Co., electricity for both public and private lighting was inaugurated in Birkhill on November 21st.

Eccles.—YEAR'S WORKING.—We have received from Mr. H. W. Angus, borough electrical engineer, a copy of his report together with a statement of accounts of the Corporation Electricity Department for the year ended March 31st last. The total revenue showed an increase from £46,964 to £50,120, while the working expenditure amounted to £36,292, as compared with £33,019 in the previous year. The gross profit totalled £13,828 (£13,944), to which was added £3,900 balance brought forward from the previous year's account and various smaller items, making a total of £18,233 available. After making provision for loan charges and transfers to general fund, electric cooker account, and reserve account, there was a net surplus of £5,037, which compares with £8,296 in 1928-29. During the year the capital expenditure amounted to £17,384, making the total now spent on the undertaking £191,253. The electrical energy sold increased from 7,798,787 to 8,478,234 kWh and the maximum demand from 3,488 to 3,672 kW. The average price obtained per kWh fell from 1.40d. to 1.37d.

A commencement was made during the year with the standardisation of the system and pressure of the supply and 168 consumers are now receiving the standard supply.

Haslingden.—Year's Working.—According to the borough treasurer's report, the electricity undertaking last year made a gross profit of £6,791, as against £6,093 in the previous year, and a net profit of £1,558. The capital outlay, during the year amounted to £12,150, making a total of £72,923 now spent on the undertaking.

Irish Free State.—Cork.—At a recent meeting of the Committee of Management of the Cork Mental Hospital a letter was read from the Electricity Supply Board in reference to the electric lighting of the Institution. The letter stated that the Board had gone carefully into the question, and estimated the cost of laying all the underground cables through the premises to the various buildings would be £1,122. The Board was prepared to contribute £500 towards the cost of the work, provided that the total lighting requirements were supplied by the Board. The matter has been referred to a special committee for consideration.

The Omagh Power House Collapse.—The Committee appointed by the Urban District Council of Omagh, County Tyrone, to consider the cause of the recent collapse of the roof of the new electric power station has reported that the occurrence was due to insufficient steel supports in the concrete. Plans for a new roof, and the completion of the power house were adopted by the Council, and it was further decided that the electricity supply should be extended along Killyclogher Road, and to the Asylum and Dromore Roads on the outskirts of the town.

Irlam.—Electricity Scheme.—The Urban District Council is applying for sanction to the borrowing of £100,000 in connection with the electricity scheme for Irlam and Cadishead. As the scheme has been designed to meet requirements for a number of years ahead, the Stretford and District Electricity Board has come to an agreement with the Irlam Council and accepts responsibility for the repayment of principal and interest during a period of 25 years. It is estimated that the work will take eight months to complete.

Japan.—Hydro-electric Developments.—The establishment of a company with a capital of 9,000,000 yen for the purpose of utilising the water power of the Kitayama River in the Wakayama Prefecture is being contemplated jointly by the Daido Power Co., the Keihan Electric Railway Co., and the Godo Electric Co. It has also been decided to form a company having a capital of 10,000,000 yen, under the title of the North-Eastern Hydro-Electric Power Co., for the purpose of developing power from the Tadami River in the Fukushima Prefecture. Mr. T. Takahashi, engineer of the Toshin Electric Co., is interested in the proposed scheme, which provides for the erection of two power stations having capacities of 15,000 and 2,200 h.p., respectively.

Liverpool.—Concrete Pole Experiment.—The city lighting engineer is to experiment with concrete poles for public lighting. If they are satisfactory they will eventually supplant the steel standards.

London.—Fulham.—The Electricity Commissioners are to hold an inquiry on December 15th at the Institution of Electrical Engineers, London, into the application of the Fulham Borough Council for permission to extend its generating station in Townmead Road, Fulham. The London County Council is recommended by its Parliamentary Committee to oppose the extensions.

The Borough Council Electricity and Lighting Committee recommends that sanction be obtained to loans of £2,562 and £2,172 for the erection and equipment of the Ongar Road and Mirabel Road sub-stations, respectively. The Council is also recommended by the Finance Committee to apply for sanction to loans of £6,300 for land, £10,000 for prospective expenditure on small mains extensions, £12,500 for wiring installations for the domestic rental scheme, and £5,000 for domestic apparatus for hire.

The extension of the domestic rental lighting scheme so as to include slot meter consumers is recommended by the Electricity Committee. As from April 1st next, therefore, it is proposed that the inclusive charge for the installation, wiring, first supply of lamps and shades, and the cost of the electricity consumed, should be at the rate of 6d. per kWh.

Islington.—The Borough Council Electricity Committee is applying for sanction to loans of £2,455 for the construction of an electricity sub-station at Flowers Mews, and £3,940 for a sub-station at Wharfdale Road.

Battersea.—The Borough Council Electricity Committee has received a communication from the Central Electricity Board stating that in connection with the South-East England Electricity Scheme, it is proposed to lay e.h.p. cables from the Battersea station of the London Power Company to the Wimbledon power station.

The Electricity Committee is to extend mains and services at a cost of £4,159.

Hammersmith.—In connection with the change of pressure of the electricity supply, the Borough Council has received sanction to loans of £1,000 for mains and services, £500 for meters, and £7,130 for the changing of consumers' apparatus, &c.

St. Pancras.—The Borough Council Electricity and Public Lighting Committee recommends the expenditure of £1,262 on the extension of mains.

Stepney.—A communication has been received from the engineer of the South-East England Electricity Scheme asking whether the Borough Council would be prepared to enter into a temporary agreement with the Central Electricity Board, whereby surplus supplies of electricity may be furnished by the Council and purchased by the Board and passed on through the Board's system to other undertakers where a shortage exists. The Electricity Supply Committee recommends the Council to provide the desired supplies.

Marlborough.—Tariff Alterations.—The scale of charges for electricity has been amended to include an optional residential subscription rate for dwelling houses with a fixed quarterly charge of 14s. for three rooms, and 4s. 6d. for each additional room, plus 2d. per kWh. To qualify for this rate consumers must install a reasonable amount of domestic apparatus or radiators.

Supply to Savernake Hospital.—The Town Council has applied for sanction to a loan of £700 for an e.h.p. overhead line to supply electricity to Savernake Hospital.

Northern Ireland.—Coleraine and Ballymoney.—The Coleraine and Ballymoney Urban District Council has decided to oppose the application of the Electricity Distribution Company for a Special Order authorising it to supply electricity over a large part of Antrim and Derry, which includes Coleraine and Ballymoney. It was stated in Coleraine that a local company was prepared to take over the Council's Special Order, and in Ballymoney that a local company had already done so.

Londonderry.—The Corporation of Londonderry has decided to promote a Bill in the Parliament of Northern Ireland giving it power to extend its electricity scheme.

Sandown.—Public Lighting.—The Urban District Council has accepted the tender of the Isle of Wight Electric Light and Power Co., Ltd., for lighting and maintaining all the existing public electric lamps for a period of three years at £700 per annum.

South Africa.—Proposed Electricity Schemes.—A scheme to modernise and extend the electricity supply at Benoni at a cost of £42,000 has been prepared by Mr. A. E. Val Davies, consulting engineer, of Johannesburg. A proposal is also being considered for supplying electricity to farmers in the vicinity of Somerset West, Cape Province, by connecting them with the lines of the Electricity Supply Commission; this scheme is estimated to cost £30,000.

Tramway and Railway Notes.

Australia.—Petrol-electric Trains.—The Victorian Railways Department is now using petrol-electric trains in certain non-electrified areas. The *Australian Electrical Times* states that investigations are being carried out with a view to ascertaining whether these trains can be fitted with a pantograph, &c., to enable them to take energy from the overhead trolley wires when travelling on the electrified portions of lines.

Brighton.—Proposed Traffic Merger.—A meeting of the Town Council was held last week to consider the promotion in Parliament of a Bill for the establishment of a Traffic Board to control the transport of the district. The Board is to consist of members of the Brighton and Hove Corporations and representatives of Messrs. Thomas Tilling, Ltd., the capital of the proposed amalgamation being estimated at £740,000.

Continental.—Switzerland.—It is claimed that Switzerland has now not only the largest percentage of electrified railways of any country but the greatest actual mileage of electrified lines, there being now about 1,040 miles in operation to be increased to 1,340 miles by the end of 1936. Italy is stated to be second in the list with 1,015 miles, and Germany third with 973 miles.

Belgium.—The work of electrifying the local railways in the Ghent district has recently been completed and electric trains are now running between Ghent and Loochristy, and between Ghent and Lovendeghem.

Kirkcaldy.—Tramway Purchase Offer.—According to the *Tramway and Railway World*, Messrs. Cormie Brothers, a local firm of omnibus proprietors, have offered to buy the Corporation tramway undertaking for £20,000. A decision has been deferred pending reports from officials in connection with the request of the Council for recommendations on an alternative method of transport. As we have already reported, the Council has decided to discontinue the tramways. The Council has also informed the Wemyss and District Tramways Co., Ltd., that there is a possibility of its applying to Parliament for an Order to abandon the tramway service and asking if the company has any proposal to put before the Council.

London.—THE KINGSWAY TRAMWAY TUNNEL.—The work on the tramway tunnel between the Embankment and Kingsway, which is being enlarged to allow double-deck cars to pass between North and South London, is now almost completed and the official re-opening will probably take place early next month.

Portsmouth.—RAILLESS CARS.—The Corporation Electricity Committee is considering the introduction of a railless-car service on the Fawcett Road-Dockyard route.

Salford.—YEAR'S WORKING.—A decrease from £458,628 to £418,833 is shown in the total revenue of the City Tramways Department (general manager: Mr. J. S. D. Moffet) for the year ended March 31st last. Working expenses declined slightly from £374,682 to £372,769, leaving a gross profit of £46,065, as against £83,946 in the previous year. Interest on loans and income from various other sources added to the gross profit made a total of £55,818, from which the following items had to be met:—Loan charges £63,420, rent of lines £11,006, and expenses in connection with Church Street property £186. There was thus a net deficiency of £18,789, as against a net surplus of £13,851 in 1928-29. A net profit of £4,226, as compared with a deficit of £1,828, was shown on the motor-omnibus undertaking.

Telegraph and Telephone Notes.

Hawaii.—TRANSPACIFIC TELEPHONY.—Sites for radio stations for telephone services across the Pacific Ocean have been purchased by the Transpacific Communication Co., Ltd., a subsidiary of the American Telephone and Telegraph Company. Construction of the stations will be commenced early next year, and the service between the United States and Hawaii is scheduled to start in January, 1932, and will be the first step in the move of the Bell system to connect its United States network with Far Eastern countries in, or bordering on, the Pacific. The establishment of services to Japan, Australia, the Philippines, and Alaska, also to ships at sea, is contemplated. The transmitting station will be at Dixon, Calif., near Sacramento. The 20-kilowatt transmitter, similar to those used for the transatlantic service, will operate on wave-lengths between 14 and 44 metres, and the antennæ will have marked directional characteristics. Other transmitters will be installed as new channels are opened. The receiving station will be at Point Reyes, Calif., on the coast north-west of San Francisco, and its antennæ will also have directional characteristics. The equipment for both stations is now being built. The radio channels set up by these stations will connect initially with the telephone system of the Mutual Telephone Company of Hawaii, which consists of wire networks on several of the islands, to be linked to each other by a low-power, short-wave, radio-telephone system that is being extended to cover practically the entire archipelago.—*Reuter's Trade Service* (New York).

Manchuria.—COMMUNICATIONS BOARD.—In the past the telephone and telegraph services throughout Manchuria have been more or less under local control bureaus, but that arrangement is gradually being changed and the entire systems are by degrees coming under the control of the Mukden Board of Communications. The Board has at present under consideration the purchase of additional automatic telephones for the cities of Tsitsihar, Harbin, Kirin, and Mukden. Additional long-distance lines are also to be erected between the principal cities.

New Zealand.—RADIO-TELEPHONY.—A commercial wireless telephone service between New Zealand and Australia was to be opened on November 25th and will be available for 10 hours daily, except Sundays. An extension of the service to the United Kingdom is expected to be available in a few weeks.

Telegraph Rates.—SOUTH AMERICA.—Further reductions in telegraph rates, to become effective on December 1st, are announced by Imperial and International Communications, Ltd., the Commercial Cable Co., and the Western Union Telegraph Co. On the same date the tariffs for several countries in Central America are to be reduced also.

SOUTH AFRICA.—By arrangement with the South African Government, cable and radio rates have been equalised, and it is expected that shortly a similar arrangement will be concluded with respect to the Indian and Australian traffic.

Telephone Density.—CITIES WITH 100,000.—There are now twenty cities in the United States with more than 100,000 telephones each, while Britain has only one, London. Germany has two such cities, and Sweden and Austria one each. New York leads the world, telephonically, with 1,811,410 telephones, only about 100,000 fewer than there are in the whole of Britain and Northern Ireland, while Chicago comes next with 987,891. Then follows London with 690,400 telephones, but all the other cities in this country fall a long way behind the cities of the United States and the Continent.

Radio Notes.

Czecho-Slovakia.—LICENCES.—The number of receiving licences in use at the close of September last was 290,395, an increase of 2,791 in the course of that month, and 18,990 more than at the end of September, 1929. Licences held in the main towns were as follows: Prague 150,904, Brno 46,425, Opava (Troppau) 35,854, Bratislava 27,172, Pardubice 18,752, and Kosice 11,288. It is expected that by the close of the year the total will reach 300,000.

Exchange Relays.—LONDON.—The Highways Committee of the Stoke Newington Borough Council reports that a proposal by a private individual to establish a radio-relay service in the borough is being considered, which would involve the establishment of a large receiving set with which overhead wires would connect with subscribers. The proposal would necessitate the crossing of streets by wires at various points, about 30 ft. above the streets, from housetop to housetop. The Committee has been advised that, provided the London Overhead Wires Act, 1891, and the by-laws made by the L.C.C. under that Act are complied with, the Borough Council, although it is the highway authority, has no power to prescribe any conditions with regard to the placing of wires over streets, or to prevent the carrying out of any scheme. In districts outside London it is not lawful for any person to fix or place any overhead rail, beam, pipe, cable, wire, or other similar apparatus over, along, or across any street without the consent of the local authority, and consent may contain such reasonable terms and conditions as the local authority may think fit; contravention is punishable by a fine not exceeding five pounds and a daily penalty not exceeding twenty shillings. The Committee has ascertained that in several cities and towns in the provinces (*e.g.*, Brighton, Clacton-on-Sea, Hull, Portsmouth, and Ramsgate) wireless broadcast relay exchanges are in operation and that licences are issued in suitable cases for the placing of lines over streets in connection therewith. The Committee is of the opinion that powers similar to those granted to local authorities under Section 25 of the Public Health Act, 1925, should be obtained for Metropolitan Borough Councils, and recommends that the Metropolitan Boroughs' Standing Joint Committee be asked to consider the desirability of asking the L.C.C. to include in the next General Powers Bill a clause giving powers similar to Section 25 of the Public Health Act, 1925, to Metropolitan Borough Councils.

WATFORD.—The Corporation Highways Committee has been informed by the Watford Tradesmen's Association and Chamber of Trades that all members of the Association connected with the supply of wireless and electrical instruments are concerned with the application to the Council for permission to start broadcast relay services, and that, if such a scheme matured, their businesses would suffer greatly and the Council would ultimately incur loss of rates. The Association suggests that the matter is bordering on municipal trading, and therefore hopes that the Corporation will not favour the proposal.

Radio on Trains.—L. & N.E. Co.'s INSTALLATION.—For the first time in England, apart from experiments carried out periodically during the past few years, a railway train has been equipped for the reception of broadcast radio-telephony, the programmes to be available to first- and third-class passengers while the train is travelling. The train in question is the London and North-Eastern Railway Co.'s dining-car express which leaves King's Cross at 10.10 a.m. for Leeds and returns during the afternoon of the same day. Both the dining-car saloons and the adjacent passenger compartments have been specially wired and fitted with multiple sockets into which headphones can be plugged, so that passengers, whilst in their seats, can listen to the B.B.C. national programme broadcast from Daventry (5XX). The restaurant car attendants will supply headphones in the compartments on payment of one shilling each per journey. The apparatus has been installed under the direction of Mr. H. N. Gresley, the chief mechanical engineer, by Messrs. L. McMichael, Ltd. At one end of the train in the guard's brake van a standard 3-valve receiving set has been installed, the energy for which is derived from a rotary-convertor coupled to the 24-volt train-lighting set, so that no additional batteries are required. The receiver is coupled to an aerial stretched along the roof of the brake van outside the train, a single wire approximately 30 ft. in length. The rotary-convertor supplies the anode, filament, and grid-bias voltages, the necessary rectifiers being housed in the receiver itself, which consists of a screen-grid h.f. valve followed by a detector and one stage of l.f. a.c. pentode valve amplification. To reduce vibration, the receiver is housed in a thickly padded wooden lock-up case. Access to the set is obtained by a drop front, but in usual practice it will be only necessary for the railwaymen responsible to close a single switch, which starts up the rotary-convertor, to bring the set into action, it having previously been tuned to the required wavelength. It is calibrated in wavelengths, a moving pointer controlled by a single knob moving over an illuminated scale and allowing for any wavelength between 200 and 2,000 metres to be selected. A pilot lamp is fitted over the motor-generator so that the person responsible will have a visual indication whether the set is on or off.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraphs Department. January 6th. Indicators. (A.X. 10403.)* Submarine cable. (A.X. 10309.)*

January 13th. Terminal strips. (A.X. 10465.)* Four sets of echo suppressors for two-wire repeated circuits. (A.X. 10523.)*

January 20th. Telephone switchboard keys and parts, including handles, make springs, break springs, and key plates. (A.X. 10517.)*

January 27th. Fuses and heat coils for the protection of telephone equipment. (A.X. 10516.)*

February 3rd. Telephone exchange power boards. (A.X. 10466.)*

January 12th. State Electricity Commission. 44,000-V switchgear and accessories for the Belmont and Colac substations. (A.X. 10543.)*

Victorian Railway Commissioners.—January 7th. Remote control circuit breakers and accessories. (A.X. 10493.)*

Barking.—December 8th. Urban District Council. Two 250-kVA transformers. (See this issue.)

Belgium.—ANDERLECHT.—Municipal Council. December 5th. (1) Sectioniser boxes, and (2) l.p. armoured cable. Particulars (Cahier des Charges), 3 fr. for each lot from Regie de l'Electricité, 4 Rue Van Lint, Anderlecht. Tenders to Hotel Communal.

Eccles.—December 8th. Works Department. Installation of electric lighting and power, wiring, fittings, &c., in the workshops and offices in Clifford Street, Peel Green. (See this issue.)

India.—NEW DELHI.—India Store Department. December 11th. Flameproof and fire-resisting cables with cotton and asbestos braided insulation, required during 1931-32. (A.X. 10530.)*

Keighley.—December 5th. Electricity Department. Metal-clad h.p. switchgear. (November 21st.)

Leytonstone.—December 1st. Electrical installation at the public wash-house, Cathall Road. Particulars (deposit £2) from Mr. A. P. Howell, Town Hall.

London.—INDIA STORE DEPARTMENT.—December 5th. Telephone instruments and gear for Uhl River hydro-electric project. (November 14th.)

LONDON COUNTY COUNCIL.—December 18th. Wiring and fittings for electric lighting in tenements at Ossulston estate, St. Pancras. (November 14th.)

December 22nd. Wiring and fittings for electric lighting in 39 blocks of tenement dwellings at the Leigham Court Road housing site, Streatham Hill. (See this issue.)

OFFICE OF WORKS.—December 2nd. Works in connection with the change-over from d.c. to a.c. at the Royal Hospital, Chelsea. (November 21st.)

December 4th. Electric passenger lift at Somerset House, Strand, W.C. (November 21st.)

Manchester. — December 3rd. Electricity Department. Twelve months' supply of static transformers. (November 21st.)

December 4th. Education Committee. Electrical installation, Burnage High School for Boys. Specification (deposit £1 1s.) from Education Offices, Deansgate.

Middlesbrough.—December 8th. Corporation. Six sets of traffic signals. (See this issue.)

Newcastle.—NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO., LTD.—January 14th. Piping equipment for power station. (See this issue.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. December 15th. Transmitters. (A.X. 10362.)*

January 19th. Electric lamps and condensers. (A.X. 10446.)*

January 20th. Resistance spools. (A.X. 10505.)*

PUBLIC WORKS DEPARTMENT.—January 27th. 11,000-V switchgear and metering for Mangahao power scheme (A.X. 10373.)*

February 24th. One set of 110-kVA outdoor switchgear, steel-work and controlling equipment. (A.X. 10507.)*

Northern Ireland.—MINISTRY OF COMMERCE.—January 1st. 33-kV wood-pole overhead transmission lines. (See this issue.)

North-West Midlands.—JOINT ELECTRICITY AUTHORITY.—Fuel for Stafford generation station. (See this issue.)

Rhondda.—December 1st. Urban District Council. Three dual-frequency, three-phase static transformers. (November 21st.)

Rochdale.—December 1st. Electricity Department. A.c. single-phase prepayment meters. (October 31st.)

South Africa.—CAPETOWN.—December 17th. City Electricity Department. Overhead line material consisting of cross arms, insulators, fly fuses, &c. (A.X. 10549.)*

Uruguay.—MONTEVIDEO.—December 9th. 450,000 metres of rubber-insulated cable and wire. (A.X. 10476.)*

West Midlands.—JOINT ELECTRICITY AUTHORITY.—December 10th. Single-circuit 33,000-V overhead transmission line supported by steel towers. (November 21st.)

December 13th. Underground cables and services in Newport (Salop) urban district. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bexhill.—Electricity Committee. Accepted:—
Cable (extension of contract for six months).—Enfield Cable Works, Ltd.

Brighton.—Electricity Committee. Accepted:—
Street lamps.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.

Croydon.—Health Committee. Recommended:—
X-ray apparatus at Cheam sanatorium (£490).—A. E. Dean & Co.

Government Contracts.—The following contracts were placed by the various Government Departments during October:—

ADMIRALTY, CONTRACT AND PURCHASE DEPARTMENT.

W./t. apparatus.—Plessey Co., Ltd.; Radio Instruments, Ltd.

Electric cable.—Anchor Cable Co., Ltd.; British Insulated Cables, Ltd.; Craigpark Electric Cable Co., Ltd.; Edison Swan Cables, Ltd.; Enfield Cable Works, Ltd.; General Electric Co., Ltd.; W. T. Glover and Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India Rubber Works, Ltd.; Johnson & Phillips, Ltd.; Liverpool Electric Cable Co., Ltd.; Macintosh Cable Co., Ltd.; Mersey Cable Co., Ltd.; Siemens Bros. & Co., Ltd.

Electric travelling crane.—Clyde Crane and Engineering Co., Ltd.

Electric generating sets.—J. & H. McLaren, Ltd.

A.c. and d.c. motors.—British Thomson-Houston Co., Ltd.; Laurence Scott & Electromotors, Ltd.

Pumps.—Drysdale & Co., Ltd.; Rees Roturbo Manufacturing Co., Ltd.

W./t. valves.—General Electric Co., Ltd.

WAR OFFICE.

Copper conductors.—W. T. Henley's Telegraph Works Co., Ltd.

Electric light fittings, &c.—General Electric Co., Ltd.; Revo Electric Co., Ltd.; J. H. Tucker & Co., Ltd.

W./t. valves.—Edison Swan Electric Co., Ltd.

Electric wire.—W. T. Henley's Telegraph Works Co., Ltd.

Air Ministry.

Electric cable.—British Insulated Cables, Ltd.
Generating sets.—Stuart Turner, Ltd.
Identification lamps.—Bulpitt & Sons, Ltd.
Microphone masks.—Telephone Manufacturing Co. (1929), Ltd.
Receivers.—Muirhead & Co., Ltd.
Relaying sounders.—A. W. Hart & Co.
Voltmeters.—E. Turner.

Crown Agents for the Colonies.

Automatic telephone exchanges.—International Automatic Telephone Co., Ltd.
Cables.—British Ropes, Ltd.; Callender's Cable and Construction Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.; F. Smith and Co.
Copper.—Thos. Bolton & Sons, Ltd.; British Insulated Cables, Ltd.
Electric capstans.—S. H. Heywood & Co., Ltd.
Meters.—Ferranti, Ltd.
Switchboard materials.—Ericsson Telephones, Ltd.
Switchgear.—Ferguson, Pailin, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Tee boxes.—W. T. Glover & Co., Ltd.
Telephone instruments.—General Electric Co., Ltd.
Train-lighting spares.—J. Stone & Co., Ltd.
Wireless equipment.—Marconi's Wireless Telegraph Co., Ltd.

Post Office.

Protective apparatus.—Phœnix Telephone and Electric Works, Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; Ericsson Telephones, Ltd.; General Electric Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.; Telephone Manufacturing Co. (1929), Ltd.; H. White & Co.
Wireless apparatus.—English Electric Co., Ltd.; General Electric Co., Ltd.; Standard Telephones and Cables, Ltd.; Walters Electrical Manufacturing Co., Ltd.
Coin-collecting boxes.—Hall Telephone Accessories (1928), Ltd.
Cable.—British Insulated Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.
Secondary cells and parts.—Alton Battery Co., Ltd.; Pilkington Bros., Ltd.
Charging panels.—Power Equipment Co., Ltd.
Charging sets.—Stuart Turner, Ltd.
Loading coils.—General Electric Co., Ltd.
Cords for telephones.—British Insulated Cables, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Reliance Electrical Wire Co.
Galvanometers.—Walters Electrical Manufacturing Co., Ltd.
Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.; Electric and Ordnance Accessories Co., Ltd.; Litholite Insulators, Ltd.; T. De La Rue & Co., Ltd.; Taylor, Tunnicliff & Co., Ltd.
Ampere-hour meters.—Chamberlain & Hookham, Ltd.
Copper wire.—Frederick Smith & Co.
Manufacture, supply, drawing-in and jointing of cable (Inverurie-Huntly).—Johnson & Phillips, Ltd.
Cabling and loading coils (Glasgow-Ayr).—Pirelli-General Cable Works, Ltd.
Electric light and power wiring (Hampstead telephone exchange).—F. Troy & Co., Ltd.
Electric lift (Whitehall telephone exchange).—Evans Lifts, Ltd.
Telephone exchange equipment.—Leicester Central; Southampton (Southampton multi-exchange area); Rottingdean (Brighton multi-exchange area); Woolston (Southampton multi-exchange area); Westcotes (Leicester multi-exchange area): Siemens Bros. and Co., Ltd. Sub-contractors for Woolston and Westcotes: Small Electric Motors, Ltd., for dynamotors. Hampton and Shirley (Southampton multi-exchange area): Siemens Bros. & Co., Ltd. Sub-contractors: Crompton Parkinson, Ltd., for charging and ringing machines; Chloride Electrical Storage Co., Ltd., for batteries. Palmer's Green; Oxford; Great Barr (Birmingham area); Staines: Standard Telephones and Cables, Ltd. Sub-contractors for Staines: Electric Construction Co., Ltd., for motor-generators and ringing machines; D.P. Battery Co., Ltd., for batteries. Ealing; Mayfair, W.; London Engineering District Intercommunication (Holborn): Automatic Telephone Manufacturing Co., Ltd. Sheldon (Birmingham area); Stoke (Hanley multi-exchange area); Hither Green: General Electric Co., Ltd. Sub-contractors for Hither Green: Crompton Parkinson, Ltd., for ringing machines; D.P. Battery Co., Ltd., for batteries.
Telephone repeater equipment.—Liverpool (extensions Nos. 2 and 3); Leeds; Aberdeen: Standard Telephones and Cables, Ltd. Bristol; Birmingham: General Electric Co., Ltd.

H.M. Office of Works.

Wiring Law Courts, Belfast.—G. McCartney.

Leicester.—Tramways Committee. Accepted:—
Tramcar motors (£196 each).—British Thomson-Houston Co., Ltd.

London.—St. Pancras.—Contracts and Stores Committee. Recommended:—
Wiring and fitting 149 flats, Clarence Buildings, Kentish Town (£623), and 176 flats, King's Cross (£620).—F. and E. Pickering.

Islington.—Electricity Committee. Recommended:—
Switchgear and apparatus in connection with extension and development of the transmission and distribution system.—Electric Construction Co., Ltd.

Newcastle-upon-Tyne.—Newcastle-upon-Tyne Electric Supply Co., Ltd. Accepted:—
Dunston "B" power station:—
Boiler house and engine room steel-frame buildings (£129,000).—Dorman Long & Co., Ltd.
Two overhead electric travelling cranes (£5,500).—J. Booth and Bros., Ltd.
Circulating water pump house equipment (£12,000).—Drysdale & Co.

Preston.—Electricity Committee. Recommended:—
Induction regulator (£2,900); 33,000-V switchgear (£15,819); 10,000-kW transformer (£3,600).—English Electric Co., Ltd.

South Africa.—Cape Town.—Electricity Committee. Recommended:—
Cable.—Dowson, Dobson & Behr, Ltd. (£2,367); British Insulated Cables (S.A.), Ltd. (£4,440); Albert Vaux, Ltd. (£14,417); British General Electric Co., Ltd. (£2,422); Standard Telephones and Cables, Ltd. (£1,543).
Motors and starters.—S.A. General Electric Co., Ltd. (£420); Crompton Parkinson, Ltd. (£168).
Service cut-outs.—British Insulated Cables (S.A.), Ltd.; Siemens Bros. & Co. (Brit.), Ltd.
Switchgear (£995).—A. Reyrolle & Co., Ltd.

Taunton.—Town Council. Accepted:—
Battery for an electric vehicle (£167).—Tudor Accumulator Co., Ltd.

Forthcoming Events.

Royal Society of Arts.—Monday, December 1st. John Street, Adelphi, W.C. 8 p.m. "Modern Domestic Scientific Appliances." Prof. C. R. Darling (Lecture II).

Electrical Society of Glasgow.—Tuesday, December 2nd. Reid's Smoke Room, Gordon Street, Glasgow. 7.30 p.m. "Illuminating Engineering: Its Practical Application." Mr. L. M. Tye.

Institution of Heating and Ventilating Engineers.—Wednesday, December 3rd. Swedenborg Hall, London. 7 p.m. "The Cost of Operating Industrial and Private Electric Generating Sets Compared with Public Supply." Mr. E. G. Phillips.

British Institute of Radiology.—December 3rd, 4th and 5th. Central Hall, Westminster, S.W. Annual congress and exhibition.

Institution of Electrical Engineers.—Thursday, December 4th. Institution, London. 6 p.m. "Loud-speakers since their Conception with Gramophone Pick-ups and Wireless Recording Apparatus." Mr. S. G. Brown.

(London Students' Section).—Friday, November 28th. Institution, London. 6.15 p.m. "Electric Traction." Lt.-Col. H. E. O'Brien. Friday, December 5th. 2.30 p.m. Visit to the Associated Equipment Co., Ltd., Southall.

(North-Eastern Students' Section).—Friday, November 28th. Armstrong College, Newcastle-upon-Tyne. 7.15 p.m. "Insulation Testing." Mr. W. A. Cooke. Saturday, November 29th. Visit to Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.

(South Midland Centre).—Friday, November 28th. Grand Hotel, Birmingham. Annual dinner.

(North-Western Students' Section).—Tuesday, December 2nd. Engineers' Club, Manchester. 7.15 p.m. "Electrical Equipment of Ships." Mr. L. A. Williams.

(Wireless Section).—Wednesday, December 3rd. Institution, London. 6 p.m. "Beam Arrays and Transmission Lines." Mr. T. Walmsley.

(Meter and Instrument Section).—Friday, December 5th. Institution, London. 7 p.m. "The Metering of Three-phase Supplies." Mr. O. Howarth.

Physical Society.—Friday, December 5th. Imperial College of Science, South Kensington, S.W. 4.45 p.m. Short papers.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, December 6th. South Wales Institute of Engineers, Cardiff. 6 p.m. "The Nickel-Cadmium Alkaline Cell." Mr. F. Watson-Mann.

Electrical Power Engineers' Association (Tees-side Section).—Saturday, December 6th. Metropole Hotel, Stockton-on-Tees. 6 for 6.30 p.m. First annual dinner.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following devices:—

CHICLE. A latex used for insulating purposes.
BEAM electrical apparatus.

Notes.

Electrical Exhibition at Stoke-on-Trent.

The second of a series of electrical exhibitions, which are to be held in Stoke-on-Trent this winter to demonstrate the many advantages of using electricity, was opened last week at the Longton Town Hall by Alderman H. Leese, J.P., chairman of the Stoke-on-Trent Electricity Committee. Besides extensive exhibits of all types of domestic electrical appliances, there were numerous examples of the application of electricity to industrial purposes, both for power and lighting, and a special section was devoted to small portable electric tools. The use of electricity for the making of pottery—one of the main industries of the district—was demonstrated and much interest was shown in an exhibit showing the comparative merits of old and new methods of lighting.

I.E.E. London Students' Dance.

The annual dance of the London Students' Section of the Institution of Electrical Engineers was held on November 19th at the Victoria Halls, London, W.C. It proved to be the most successful yet held by the younger generation and it was found necessary to close down the application list for tickets several days before the event, having regard to the accommodation available. The function will therefore probably prove a success from the financial point of view also, but this may be regarded as a point of minor importance in view of the service events of this kind render to the Institution in bringing future corporate members together. Variety was ingeniously introduced into the proceedings, and the sprinkling of "elder statesmen" appeared to enjoy the evening as much as did their hosts. The dance was organised by Mr. J. W. Moffatt, while Mr. L. S. Crutch (chairman of the Section) acted as Master of Ceremonies.

Educational.

UNIVERSITY CORRESPONDENCE COLLEGE, Burlington House, Cambridge.—The London University Guide and University Correspondence College Callendar for 1931-32 (price 2s. 6d.) has recently come to hand. This publication, which has not been issued since 1927, forms a handy book of reference giving, in a simplified form, all such information with regard to matriculation and external examinations of London University as the student is likely to want. Regulations, syllabuses, and advice as to appropriate textbooks for preparation for these examinations are given and the book is consequently of great interest to private students, teachers, and those engaged in the administration of local education.

Electricity Tariffs.

The following method of arriving at the standing charges for a two-part tariff is put forward by a correspondent. It is suggested that the ideal basis is the kVA of maximum demand, which system is probably not more generally used for one or other of the following reasons: expense of accurate and reliable instruments; unsuitability of cheaper type of instrument; and possible variation of amount of charge from quarter to quarter, resulting in friction between consumer and supplier. The proposal is to limit the demand of small consumers by means of automatic free-handle switches, with thermal time lags and instantaneous short-circuit protection, and to adjust the charge for kVA of M.D. according to the size of the installation, large consumers being given the option of having the demand measured. The actual charges made will, of course, vary in different localities, according to the efficiency and size of the suppliers' system, but they should in all cases bear some definite relation to each other for all classes and sizes of consumer. As a general principle it is assumed that consumers of over, say, 500 kVA can be supplied at a kWh charge equal to the cost per kWh distributed from the power station, plus distribution losses, and a standing charge per kVA equal to the interest and depreciation on the capital involved, and that consumers of, say, between 500 kVA and 10 kVA, can be supplied at the same standing charge, plus a kWh charge the same as the above as a minimum, and rising to the cost per kWh sold as the kVA of M.D. falls, the cost per kWh sold to include all distribution, management, and office charges. The remaining consumers (numerically a large proportion of the total) can be charged at a kWh cost equal to the total cost per kWh sold, plus a charge per kVA commencing at the above basic charge, and rising to a predetermined point according to the kVA of maximum demand. The following table illustrates the above suggestion, the variation in cost being based on a curve the maximum and minimum points of which are predetermined. The charges are not based on actual experience.

kVA of M.D.	Cost per kVA per quarter.	Cost per kWh. H.p	L.p.
500 and over	£1 10 0	.49d.	.52d.
Under 500 and over 400	£1 10 0	.50d.	.53d.
Under 200 and over 150	£1 10 0	.61d.	.64d
Under 75 and over 50	£1 10 0	—	.88d.
Under 10 and over 8	£1 10 0	—	1.06d.
Under 4 and over 3	£1 17 6	—	1.06d.
Under 1.5 and over 1.0	£2 12 6	—	1.06d.
Under .25	£2 18 6	—	1.06d.

The principle of increasing the kVA charge on small installations, instead of increasing the kWh cost, is believed to be the best method of meeting the heavy servicing, metering, meter-reading and billing charges on small installations, and encourages the use of small-capacity long-hour domestic appliances. The general advantages of the proposed method of limiting the consumers' maximum demand are as follows: the switch replaces suppliers' main fuses; the standing charge does not vary from time to time; the consumer is encouraged to keep his maximum demand low; the consumer is encouraged to use domestic appliances during off-peak hours; assuming that the supply is interrupted by a fault in the installation, supply can be restored by the consumer directly the faulty circuit is cleared (it generally clears itself); the careful consumer limits his costs, the indifferent consumer pays for his lack of interest; unauthorised extensions are automatically prevented within reasonable limits; on systems where a two-part tariff for small consumers was not previously in operation the number of meters is reduced, as all classes of load pay the same price per kWh; the thermal time lag prevents the interruption of supply by the relatively heavy starting currents of small domestic apparatus, &c.; the system differentiates between low power factor apparatus and lighting. In conclusion, a fuel clause is recommended for the larger low-rated consumers, and an alternative flat rate for all purposes equal to the maximum permissible charge per kWh for those consumers who will not accept the two-part tariff.

A New Diesel-electric Oil Tanker.

The Diesel-electric oil tanker *Winkler*, built to the order of the Atlantic Refining Co., Philadelphia, has been launched by Scott's Shipbuilding and Engineering Co., Ltd., Greenock. The owners already have a fleet of nine vessels of this type. The prime movers in the case of the *Winkler* consist of four single-acting Diesel engines, working on the four-stroke cycle at 225 r.p.m. Each engine is coupled direct at the after end to one main and one auxiliary electric generators. The engines are of the Carels-Ingersoll-Rand type; each has six cylinders, 19¼-in. dia. by 24-in. stroke, and is designed for an output of 750 b.h.p. Solid-fuel injection is used. The main generators, each of 600 kW capacity, work in series at 250 volts, and supply current at 1,000 volts to the main propelling motor, which is of the double-armature type and is designed to transmit about 2,800 s.h.p. at 95 r.p.m. to the propeller. A thrust shaft and Michell thrust block are interposed between the motor shaft and the propeller shaft. The propeller motor is controlled from the pilot house on the bridge, which puts the movements of the vessel entirely in the hands of the deck officers. All the auxiliaries on the vessel are electrically driven, including two 80-h.p. cargo oil pumps. The whole of the switchgear is arranged in a room stretching across the centre of the ship for about 30 ft. at the main deck level and conveniently placed in relation to the main generators and the main propelling motor. All the motor controls are arranged within this room, but each motor is operated by push-button at its site, except in the case of the main propelling motor. The whole of the electrical installation, including motors for auxiliaries, has been supplied by the British Thomson-Houston Co., Ltd., Rugby. The steering gear is of the electro-hydraulic type manufactured by Messrs. John Hastie & Co., Ltd., Greenock, and is provided with a gyro pilot for automatic steering.

London and Home Counties Inquiry.

The inquiry concerning a draft Order amending the London and Home Counties Electricity Order, 1925, was continued by the Electricity Commissioners at Savoy Court, London, on Wednesday and Thursday of last week. Sir John Brooke, the deputy chairman, presided. Mr. F. W. Purse, chief engineer of the London and Home Counties Joint Electricity Authority, was cross-examined by Mr. F. J. Wrottesley, K.C., who represented several of the opposing companies. Mr. Purse said that it would not be necessary to employ any extra staff for the co-ordination proposed, and that a considerable saving would be effected by the use of the existing staff over the larger area. A large area could be operated by bulk supply with a resultant reduction in price; if that was not the case, the whole electricity supply system of the country was built up on the wrong lines. Giving evidence, Mr. W. F. Marchant, chairman of the Authority, stated that his Authority,

as well as the greater number of municipal authorities in the area, thought it very desirable that the rights of compulsory purchase should be transferred to the Authority itself. Speaking on behalf of the Metropolitan Electric Supply Company, Mr. Craig Henderson, K.C., said that if the Order was passed it would have a most serious effect on the electricity world in general. The draft Order was a roundabout method of obtaining something which Parliament had previously refused. Mr. F. J. Wrottesley, K.C., representing a number of the opposing companies, endorsed what Mr. Craig Henderson had said, and added that the Authority's proposals were directly contrary to the London electricity settlement of 1925, and that no figures apparently were available which showed how the Authority proposed to reduce its charges for electricity. Replying, Sir Lynden Macassey said that the consumers' interests must be their first consideration, and he was confident that it was by the scheme proposed by the Authority that those interests could best be served. The inquiry was then concluded.

A New Unit of Power.

The British Institution of Automobile Engineers is recommending for general adoption a new unit of power drawn up by Mr. Hedley G. Thomson, A.M.Inst.C.E. The basic reason for the new unit is that in most problems involving statements of power the relation between torque and speed is unnecessarily obscured if the factors are expressed in terms of fundamental units, such as ft.-lb. per minute, or per second, which is undesirable, since so large a proportion of mechanical power is delivered by the torque of a rotating shaft. Its definition is as follows: if N=rev. per minute of a given shaft and T=torque in lb.-ft. by or on the shaft, then 2η TN=ft.-lb. per minute transmitted. The new unit of power is defined to be the power transmitted by a torque of one lb.-ft. at one revolution per minute and power is thus represented by the simple product TN. This new unit is called the "Torev" and some useful equivalents are:—

1 Torev=2η ft.-lb. per min.=0.0001904 h.p.
1 watt=h.p./746=5252.1/746=7.04035 Torevs.
1 kW=7040.35 Torevs.

In calculations relative to steam engines, belt, and gear transmissions the two factors of torque, namely, force and radius, at which it acts are more often met with alone and without reference to the conception torque; but in the more modern application of electrical machinery, and of internal-combustion engines, torque almost invariably appears. For example, if the iron loss in an armature rotating at 800 rev. per minute amounts to 500 watts, what is the corresponding drag on the armature?

500 watts=500×7.04 Torevs=3,520 Torevs.
Hence drag=3520/800=4.4 lb.-ft.

The Electrical Association for Women.

The winter fixtures of the Leeds and West Riding branch include: December 3rd, lecture by Mr. Geo. S. Francis on "The Influence of Electricity on Architecture, Furnishing and Decoration"; January 21st, 1931, lecture by Mr. R. A. Thwaites on "Rural Electricity"; February 3rd, lecture by Mr. V. W. Dale on "More plugs or Outlets—E.A.W. and E.D.A."; March 4th, lecture by Mr. R. M. Longman, M.I.E.E., on the "Grid Electricity Scheme"; March 25th, demonstration on "Cooking by Electricity"; May 6th, visit to the new Leeds power station at Kirkstall (provisional).

By permission of Sir William Sutherland, thirty members of the Leeds branch visited the Woolley Colliery, near Barnsley, of Messrs. Fountain & Burnley on November 19th. At the termination of the proceedings Mr. T. Lomas, the manager, instanced the remarkable efficiency that had been obtained by the use of electricity. The Yorkshire Electric Power Company, which supplied the energy, had carried out all the installation work, and there was no doubt that the colliery was one of the most up-to-date in Yorkshire. Mr. J. Loft, chief engineer to the colliery company, also referred to the advantages of electricity, and said that since 1915, when they first received a supply, they had progressively adopted electricity for various purposes, until at the present time they carried out practically the whole of their operations by this means. An informative pamphlet, "Electricity and Coal," depicting the development of electrical usage in the winning of coal, was issued by the Power Co.

At the last monthly meeting of the North Staffs. branch the members were addressed by Mr. C. H. Yeaman, city electrical engineer of Stoke-on-Trent, who dealt with the points raised in an article entitled "What Does It Cost." in the April issue of the *Electrical Age for Women*. Mr. Yeaman showed that, in the case of the all-electric houses built by the Stoke-on-Trent Corporation, the average cost per week for electrical energy during the past year was 8s. 5d., including all the domestic services, such as room heating, cooking, water heating, &c. In the case of Mr. Yeaman's own house he pointed out that during the past year he consumed 13,290 kWh at a cost of £30 5s. 2d., with the low average price of only 0.546d. per kWh.

Under the auspices of the Glasgow branch of the Association, a lecture was given on November 19th by Mr. Alex Lindsay, M.I.E.E., on modern forms of heating, in which he dealt in an instructive way with tubular and panel heating, with thermostatic control.

E.P.E.A. Dinners.

The eighth annual dinner of the West Yorkshire Section of the E.P.E.A. at the Hotel Metropole, Leeds, on Saturday, November 22nd, broke previous records for attendance, nearly 200 people sitting down to dinner. The social side was given special prominence, the toast list was cut down, and the greater part of the evening was given over to dancing. Presentations were made to Mr. R. H. Toynbee and Mr. H. P. Wadsworth, in recognition of their services as chairman and secretary, respectively; Mrs. Toynbee and Mrs. Wadsworth also received gifts. At the dinner, with Mr. A. R. Brown in the chair, the toast of the Association was proposed by Mr. D. Maxwell Buist, engineer to the Central Electricity Board, North-East England Area; who, after recalling his early connections with the Association, said that he considered the chances of promotion in future for the members of the electrical profession were greater than they had ever been in the past, but that the younger men would do well to pay special attention to the problems of distribution and salesmanship. The toast was responded to by the president of the Association (Mr. A. V. Sendell) who expressed appreciation of the sentiments of Mr. Buist to the Association and of his advice to the younger members, and gave his opinion that the status of the electrical power engineer had never been so high as it was to-day. Mr. J. F. Sarvent proposed the toast of the ladies and guests. Mr. A. L. Lunn, who had a great reception from the company, responded, and said he looked forward to a great future for the Association, and reminded those present who were now engaged in the industry that, as there were likely to be fewer power stations soon, it behoved them so to equip themselves that they might be ready to take on some other phase of service.

The twelfth annual dinner of the South Coast section of the E.P.E.A. was held at the Bungalow Café, Southampton, on November 15th. Mr. J. B. R. Howat, chairman of the section, presided. Following the loyal toast, Alderman F. R. Brown proposed that of the Association. He said that, as chairman of the Southampton Electricity Committee, he had cause to be thankful for the existence of the Association, and he was pleased to hear that it was in such a flourishing condition, with a membership of something like 4,000. Naturally the Association was formed primarily to protect the members' interests, a right and proper thing to do, but beyond that it had on many occasions helped along the electrical industry. He recalled the meeting of the employers and the Association to formulate the scheme for the training of electrical engineers. The Association was concerned with raising the status of the profession, and it was only by getting experts in the profession that they could raise it. It also gave confidence to the employers to know that their men were members of such an important body. Mr. A. E. Ricketts (senior vice-president of the Association), responding, claimed that the Association could supply the men who could run the supplying industry efficiently and well. By co-operation in the technical groups between the manufacturers and the men who operated machinery, they could get things better in the future than they were at the present time. The health of the visitors was proposed by the chairman and responded to by the Mayor.

Appointments Vacant.

Electric traction engineer for Messrs. Robert White and Partners.

Costing clerk for Kingston-upon-Hull Electricity Department.

Consumers' clerk for Wimbledon Electricity Department.

Boiler-house engineer for the Lydney power station of the West Gloucestershire Power Co., Ltd.

Electrician-in-charge for Hornsey Electricity Department.

(See our advertisement pages to-day.)

Manchester Electro-Harmonic Society.

The Manchester Electro-Harmonic Society held its second concert of the season at the Manchester Limited Restaurant on November 21st. An excellent programme of concert items was presented to a good audience of members of the electrical and allied trades.

The Drumm Battery.

In the Free State Dail on November 19th Mr. Ernest Blythe, Minister of Finance, received permission to introduce a supplementary estimate under the heading of "Electrical Battery Development." It is assumed that this refers to the Drumm battery, concerning which articles were published in the ELECTRICAL REVIEW of August 22nd and September 19th, 1930.

Battersea Power Station.

The second report of the committee which has been investigating the treatment of sulphur fumes from the Battersea power station of the London Power Co. was published recently (H.M. Stationery Office, CMD 3714, 4d. net). The committee is satisfied from tests carried out at the Grove Road power station of the same company that it is practicable to install in connection with the first section of the Battersea station a plant which will reduce the emission of sulphur fumes to a negligible quantity, and that the liquid effluent from such a plant can be so treated as to be admissible into the river. It is anticipated that with a gas-washing plant of ample capacity, and the use of iron as a catalyst, up to 85 per cent. (at least) of the sulphur can be eliminated without the use of soda or other alkali.

A Remotely-controlled Tugboat.

A new kind of electric tug has recently been put in service on the St. Lawrence River, U.S.A. It tows car floats between the New York central terminus at Ogdensburg and the Canadian Pacific Railroad terminus at Prescott, Ontario. When the float is ready to leave the tug is attached, electrical connection is made, and the pilot leaves the tug and boards the car float. The trip is then made with the pilot on the bridge of the towed boat, all the operations of the machinery on the tug, steering, &c., being controlled from that point. Remote control was essential to the proper operation of the towage system. The tug is small, compared with the car float, and were the pilot to remain on the former he would not see well enough to control the movements of the two boats. The tug was built by the Canada Steamship Lines at Levis, Quebec, of steel, is 120 ft. long, and is propelled by Diesel-electric drive. It is said to be the first example of its kind, and also the first electric tug on the St. Lawrence River. The steel car float has three tracks with a capacity of 23 cars. Electricity for propelling the tug is supplied by two generators rated at 330 kilowatts, 250 volts, 245 r.p.m., and driven by two Diesel engines. Power for auxiliary purposes is supplied by two generators also driven by the Diesel engines and rated at 50 kilowatts, 120 volts, 245 r.p.m. The propeller is driven by a directly-connected motor rated at 800 h.p., 105/135 r.p.m., and of double-unit construction. Control of the propulsion machinery is of the variable-voltage type. Three operating stations are provided, one in the engine-room, one in the pilot-house, and a third on the bridge of the car float.

The Grid System.

In the House of Commons on November 19th COMMANDER BELLAIRS asked the Minister of Transport, in view of the future dependence of the country on the grid system of electricity supply and the highly technical character of the work, whether he would arrange with the Admiralty for naval ratings to be specially trained so that an alternative service of *personnel* might be always available.

MR. MORRISON replied in the negative. He said that such a step had not been taken in the past, and he saw no occasion for taking it now.

Kinema Supervision.

On October 14th Edinburgh magistrates approved of a scheme for the supervision of kinematograph theatres and recommended that a supervisor be appointed. The firemaster is to report to the electrical engineer should any change be made in the wiring or electrical fittings on any premises, or anything affecting the electrical wiring or installation calling for consideration. The electrical engineer is to inspect all premises annually. It is recommended also that he should have the right of entry at any time and that he should examine the electrical installations of theatres on every change of programme.

Electricity on Ships.

The annual report of Lloyd's Register of Shipping for the year ended June 30th, 1930, shows that the total number of vessels fitted with steam turbines that was classed by the Society during the year amounted to thirteen, of 100,486 tons. In the s.s. *Santa Clara*, of 9,373 tons, the turbo-electric drive is employed, but in the remainder the turbines are used in conjunction with reduction gearing. The turbo-electric drive is also being employed in three large twin-screw vessels now under construction to the Society's class, *viz.*, the *Strathaird*, 21,500 tons, and *Strathnever*, 21,500 tons, being built by Messrs. Vickers-Armstrongs, Ltd., at Barrow, for the Peninsular and Oriental Steam Navigation Company, and the quad. sc. *Mid Ocean*, 17,500 tons, being built by Messrs. Vickers-Armstrongs, Ltd., at Newcastle for Messrs. Furness, Withy and Co., Ltd. The electrical equipment for the two P. & O. vessels is being constructed by the British Thomson-Houston Co., Ltd., Rugby, and that for the *Mid Ocean* by the General Electric Co., Ltd. The Bauer-Wach system of connecting an exhaust-steam turbine to the main shafting of steam reciprocating engines by mechanical gearing and hydraulic clutch has been adopted in nine new vessels, of 45,430 tons, classed by the Society during the period under review, and the satisfactory performance of vessels in commission thus equipped has led to a further number of existing steam reciprocating engines being converted to this system. In another new vessel, the s.s. *City of Barcelona*, of 5,698 tons, fitted with steam reciprocating engines, an exhaust-steam turbine drives a directly-coupled electric generator, which supplies power to a motor mounted on the intermediate shafting (see ELEC. REV., April 25th and August 1st, 1930.) Some of the Society's rules have been amended and added to, including those governing the installation of electrical fittings on board ship.

At the request of the State Electricity Department, Monte Video, the Society's surveyors have undertaken the inspection during construction of a power station of 50,000 kW capacity for that city. The steam turbines and electrical generating plant are being supplied by the Metropolitan-Vickers Electrical Co., Ltd., of Manchester, and the water-tube boilers by Messrs. Babcock & Wilcox, Ltd.

"F.P." Circuit-breaker Tests.

Brochure No. 32A2 of Messrs. Ferguson, Pailin, Ltd., which is fully illustrated, including reproductions of oscillogram records, discloses considerable data relative to a second series of rupturing tests carried out in April and May, 1930, on their round-tank, oil-immersed, circuit breakers at the Schenectady laboratories of the General Electric Co. of America. Reference was made in our October 31st issue, p. 750, to similar proving tests imposed on their "R"-type switchgear. Kinematograph films taken during the tests on "VR"-type breakers of 16-, 20-, 24-, and 28-in. tank diameter, and exhibited in London last week, indicate the enormous forces liberated under short-circuit conditions. Dr. E. J. Berg, professor of electrical engineering at the Union College, Schenectady, N.Y., witnessed the tests, and has certified that all the four breakers behaved completely satisfactorily, with little or no external evidence of the hardships to which they had been subjected. There was comparatively slight burning of the contacts, even after many successive short-circuits; in most cases the contacts would not have been incapable of further service. Subsequently the breakers were subjected step-by-step to short-circuits of extreme severity, well beyond their intended ranges, in order to discover possible inherent weaknesses or limits of endurance; even then in no case was the resultant damage particularly severe nor was there any distortion of the tanks and containers. He has no hesitation in saying that these breakers are conservatively rated and designed.

An A.S.E.E. Social Function.

A successful social function was held by the London district of the Association of Supervising Electrical Engineers at the "Ye Mecca" Restaurant, Ludgate Hill, London, E.C., on November 22nd. The company numbered some 240, amongst whom were Mr. S. B. Donkin, the president of the Association, and Mrs. Donkin. The proceedings commenced with a whist drive, followed by dinner and dancing, making a continuous programme from 5.30 to 11.30 p.m. The chairman of the Association, Mr. F. W. Smith, presided at the dinner, and the toast of the ladies was proposed by Mr. S. B. Donkin, and responded to by Mrs. E. North. During the dinner appropriate music was played by the Connaught Dance Band, which also provided music for the dance. The M.C.s' for the whist drive and dance were Mr. A. Brammer and Mr. E. H. Eastell, respectively.

Institution Notes.

Institution of Electrical Engineers.

PORTRAIT PRESENTATION.—At the ordinary meeting of the Institution on November 20th Mr. Ll. B. Atkinson presented to the Institution, on behalf of the late Mr. E. Garcke, a three-quarters length oil painting of Ampère. Mr. C. C. Paterson, president, accepted the portrait on behalf of the I.E.E. It is a dramatic work of art by Mr. Edward Maxence, Membre de l'Institut de France, of a style which differs considerably from that of the other portraits hanging in the lecture theatre. The artist was guided by two old full-face and two profile sketches, from which he made in turn a clay model, a full-length drawing to fix the pose, a small model complete and dressed in the costume of the period, from which the portrait in oils was finally produced.

NEW LIST OF MEMBERS.—A new official list of members of all classes, corrected to September 1st, 1930, including a list of names arranged geographically, is now available. Any member wishing to receive a copy should apply to the secretary.

SCOTTISH CENTRE.—The annual dinner was held in Glasgow on November 18th. Lord Salvesen, who presided, proposed the toast of "The Institution," and referred to developments since 1871. Invention was not dead yet, and he felt that they could expect, if not as great things in the future, the development and perfection of those great things which had come. Mr. C. C. Paterson, president, replied, and said that the Institution was looking to the future by regarding it as the right of their students to keep abreast with them. "The Scottish Centre" was proposed by Mr. B. Hamer Leeson, chairman of the North-Eastern Centre, and replied to by Mr. Edwin Seddon, chairman of the Scottish Centre. A dance followed.

Association of Mining Electrical Engineers.

FIFESHIRE BRANCH.—A Fife branch of the Association of Mining Eectrical Engineers has been formed, taking the place of the old East of Scotland branch formed over 20 years ago. The president is Mr. C. C. Reid, and the vice-presidents are Mr. J. Dawkins (late secretary of the East of Scotland branch) and R. W. Peters. A number of speakers have been secured for the present session, and among those who attended the first meeting on November 15th were the president of the Association, Mr. James Gibson, London, and many members of the electrical engineering profession.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. G. Scott Ram is retiring from the position of Senior Electrical Inspector of Factories, under the Home Office, on December 1st. Mr. Scott Ram commenced his electrical career with the Hammond Electric Light & Power Co., and was one of the first batch of students at the Hammond Electrical Engineering College, the forerunner of Faraday House, in 1882. He then went to Messrs. Goolden & Trotter in their instrument department under Mr. Sydney Evershed, and was later connected with their electrical coal-cutting activities. He was for two years in New York with a company manufacturing electric lamps and instruments. In 1893 he published a book on "The Incandescent Lamp," one of the *Electrician*

Hlisted] [*London.*

Mr. G. Scott Ram, M.I.E.E.
Who is retiring from the position of Senior Electrical Inspector of Factories.

series of publications. He then joined the staff of the late Mr. Robert Hammond, representing him on various of his electricity supply undertakings, Leeds, Blackpool, and Coventry; he was City Electrical Engineer of the last-named place for six years. He then went to the Nernst Electric Lamp Co., whose lamp was the first improvement in efficiency on the carbon-filament lamp. In 1897, a Home Office Departmental Committee on Dangerous Trades published a report on electrical generating works, and made recommendations as to the safety of persons working in generating stations and substations, which were not brought within the scope of the Factory Acts until 1901. Mr. Ram was appointed as the first Electrical Inspector in 1902, and on him devolved the duty of drafting a code of regulations dealing with the generation and use of electricity on premises under the Factory Acts. These draft regulations were the subject of a public inquiry in 1908, held before a Commissioner, Mr. James Swinburne, from which an agreed code of regulations resulted, which came into force in January, 1910. These regulations have had considerable influence upon the design of electrical apparatus, from power-station switchboards down to the small apparatus on consumers' premises and, it is generally agreed, have had a beneficial effect in improving the standard of safety generally. Mr. Ram himself initiated the designs of various pieces of apparatus now in common use. His published annual reports have contained a great deal of information regarding electrical accidents, and have included very useful suggestions for their prevention. During his first six years with the Home Office, there being then no Electrical Inspector of Mines, Mr. Ram was called upon to act in that capacity. Mr. Ram became an associate member of the I.E.E. in 1887 and a member in 1897, and has served on the Council and various committees. He has also served on many of the B.E.S.A. committees. In 1922 four additional Electrical Inspectors of Factories were appointed, and one of them, Mr. H. W. Swann, succeeds him as Senior Electrical Inspector. The work of the electrical department having greatly increased, we understand, that the Home Office is appointing five additional Electrical Inspectors, who, according to a recent advertisement in our columns, will all be electrical engineers of experience.

Mr. F. G. Kellaway, who, we regret to hear, recently sustained an injury whilst riding, was on November 21st removed from his home at Westerham to a London nursing home where he underwent a serious operation. His condition is reported to be satisfactory. Mr. Kellaway is deputy-governor and managing director of Cables & Wireless, Ltd.

Mr. Massie-Blomfield, M.A., who, as we report in our "Business Notes," has been appointed to take charge of the branch Trade Commissioner's office in Jamaica, has served as intelligence officer in the Department of Overseas Trade since 1923.

Mr. C. Nelson Hefford, general manager of the Leeds Corporation Electricity Department, has been elected president of the Leeds Electrical Club for the forthcoming year, in succession to **Mr. W. B. Woodhouse.**

Mr. H. Wilson, electrical engineer to the Ashford (Kent) Urban Council, has been elected president of the Ashford and district branch of the National Association of Local Government Officers.

Mr. H. R. Burroughes, who, as we reported last week, has retired from the position of meter superintendent at Norwich, has been presented with a portable radio set by the Norwich Engineering Society, of which he was hon. secretary for six years.

Mr. F. S. Hayburn, deputy managing director of the Marconi International Marine Communication Co., Ltd., with his wife and daughter, were passengers on the wrecked *Highland Hope*. After a perilous hour in a lifeboat, sitting in water up to their hips, they were rescued by a fishing boat and landed at Peniche. Mrs. Hayburn's back and legs were hurt necessitating a few days' rest before she was able to resume her journey.

Mr. J. Nelson, Rio de Janeiro representative of the Metropolitan-Vickers Electrical Co., Ltd., was also among the passengers of the *Highland Hope*. He was returning to Brazil after a holiday and is reported to be safe.

At last week's meeting of the Overhead Lines Association, **Major Theodore Rich** was presented with a leather bag, a slide rule, and a fountain pen as a mark of appreciation of the work which he did as hon. secretary to the Association during last session.

Mr. H. W. Swann, Mr. G. Scott Ram's successor as Senior Electrical Inspector of Factories, is an old Persean and a

Elliott & Fry] [*London.*

Mr. H. W. Swann, A.M.I.E.E.
The new Senior Electrical Inspector of Factories.

Faradian. He served in pupilage with Ruston's, Veritys, and the Isle of Thanet Company, afterward holding appointments with Callender's and the Metropolitan Electric Tramways Co. He was with the North Metropolitan Company first as a resident engineer and later as outside superintendent. For the past nine years he has worked under Mr. Ram at the Home Office, and he takes over his new duties on December 2nd.

Obituary.

Mr. W. Hamilton.—We learn with regret of the death of Mr. William Hamilton, B.Sc., Wh.Sch., at the age of 62, in a Manchester nursing home. Mr. Hamilton's association with electrical engineering began through a chance meeting with Lord Kelvin on the s.s. *Scott*, when Lord Kelvin was on the way to South Africa. The great scientist took an interest in the young engineer, and advised him to go to the University, as a result of which he studied and took his degree; he later worked in the laboratories of Glasgow University, subsequently joining the firm of Kelvin & Bottomley. Mr. Hamilton will, perhaps, be best remembered by the great work which he did during his 17 years with Ferranti, Ltd., first as experimentalist and later as manager. The electricity meters sent out by that company once bore the simple legend "Hamilton Patent." In 1916 he retired from business life, but in 1921 he returned once more to harness, and since that time had occupied the position of chief engineer, designer, and experimenter at the Salford works of the General Electric Co., Ltd. (Salford Electrical Instruments, Ltd.). A brilliant mathematician and a most thorough investigator of all kinds of problems, he had a kindly and retiring disposition, and a great faculty for teaching, instructing, and advising those who worked under him, and he was greatly loved and revered by his colleagues.

Mr. Emile Garcke.—We have received the following appreciation of the late Mr. Emile Garcke from Mr. H. G. Massingham:—"It was with deep regret that I read of the death of Mr. Emile Garcke, whom I had the pleasure of knowing from the early days of the electrical industry in this country, when he was first associated with the Anglo-American Brush Co., which is going back a great many years. At a later period he was associated with me in the City of Bath electricity supply undertaking, of which I was the original owner, now the property of the Bath Corporation. There is so much to be said about Mr. Garcke, that all I will now say is, that to know him was to love and respect him.—H. G. MASSINGHAM."

Wills.—Mr. John A. Dumbrell, electrical engineer, late of Sydenham, S.E., left estate valued at £7,731 (£1,472 net personalty).

The late **Mr. Joseph Briggs**, manager of Richard Johnson and Nephew, Ltd., left £5,022 gross (£4,497 net personalty).

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

National Radio Co., Ltd.—Private company. Registered November 17th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in gramophones and records, voice and sound reproduction, wireless receiving and transmitting apparatus and accessories, &c. The subscribers are: R. J. Lardner, 62, Victoria Road North, Southsea, Hants, solicitor's clerk; Hilda C. Charlton, 30, Bristol Road, Southsea, clerk. Registered office: The Trading Estate, Slough, Bucks.

Hanson & Hanson, Ltd.—Private company. Registered November 15th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical and mechanical engineers, press and press tool makers, makers of gramophones, radio sets, &c. The directors are: C. J. W. Hanson, Mrs. Sarah A. Hanson, and A. C. W. Hanson, all of 143, Rosebery Avenue, E.C.

Kensal Radio Manufacturing Co., Ltd.—Private company. Registered November 21st. Capital, £600 in 525 8 per cent. cumulative preference shares of £1 each and 150 ordinary shares of 10s. each. Objects:—To carry on the business of radio and radio-gramophone manufacturers, dealers in radio, gramophone, electrical and wireless materials, &c. The permanent directors are:—A. P. Balls, "Bracondale," The Crescent, Sidcup, radio engineer (chairman); D. B. Fergusson, 31, Sundew Avenue, W.12, engineer; J. Duran, 52, Hubert Gardens, Kensal Rise, radio engineer. Registered office: 104-106, Chamberlayne Road, Kensal Rise, N.W.10.

Photographic Electrical Co., Ltd.—Private company. Registered November 21st. Capital, £100 in £1 shares. Objects:—To acquire patents and rights in connection with inventions relating to the photographic method of recording sound on celluloid or other material and of projecting or translating sound so recorded; and to carry on the business of producers and manufacturers of, and dealers in, kinematograph films, kinematograph and photographic machines, photographic records, &c. The subscribers (each with one share) are:—C. Osborne, 11, St. Oswalds Road, Norbury, S.W.16, clerk; H. Braten, 264, Dollis Hill Lane, N.W.2, clerk. Solicitors: Last, Riches & Fitton, 18, Bolton Street, Piccadilly, W.1.

Official Returns of Electrical Companies.

H. A. Stonham & Co., Ltd.—Capital, £1,200 in £1 shares. Return dated July 8th, 1930. 1,200 shares taken up. £1,200 paid. Mortgages and charges, nil.

Nox Electric Lamp Co., Ltd.—Capital, £15,000 in £1 shares. Return dated August 6th, 1930. All shares taken up. £14,500 paid. £500 considered as paid. Mortgages and charges at date of return, £12,200 (paid off September 30th, 1930).

Newey & Eyre, Ltd. (formerly W. H. Price & Newey, Ltd.).—Debenture dated November 10th, 1930, to secure £2,245, charged on the company's undertaking and property, present and future, including uncalled and unpaid capital and goodwill. Holder: A. H. Newey, 14, Southam Road, Hall Green, Birmingham.

Sydney W. Bussell, Ltd.—A. E. Tilley, 8, Staple Inn, W.C.1, was appointed receiver and manager on November 13th, 1930, under powers contained in debenture dated May 24th, 1927.

Gambrell Bros., Ltd.—Charge on land, buildings, fixtures, &c., in Merton Road, Southfields, dated November 4th, 1930, to secure all moneys due or to become due from the company to the National Provincial Bank, Ltd.

Electric and General Industrial Trust, Ltd.—Issue on November 13th, 1930, of £2,800 debentures, part of a series already registered.

Harris Williams (Manufacturers), Ltd.—Debenture dated October 31st, 1930, to secure £9,000 and further advances and sums due on any account whatsoever, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: T. Hall, 37, Groat Market, Newcastle-on-Tyne.

Ray-Beam, Ltd.—Debenture dated November 8th, 1930, to secure £500, charged on the company's property, present and future, including uncalled capital. Holder: Mrs. S. J. Holland, 22, Esmond Road, Cheetham Hill, Manchester.

Edmundsons' Electricity Corporation, Ltd.—Issue on November 12th, 1930, of £380,000 debenture stock, part of a series already registered.

Underground Electric Railways Co. of London, Ltd.—Particulars filed of £6,750,000 debenture stock with premiums in certain events (including £4,750,000 previously registered) authorised as to present issue of £2,000,000 on October 23rd, and covered by supplemental trust deed dated November 10th, 1930. Property charged: Stocks, shares and securities, set out in particulars dated October 17th, 1928, and March 31st, 1930, and in addition thereto, 130,000 ordinary shares of £10 each in the Associated Equipment Co., Ltd., and 895,028 cumulative preference shares of £1 each in the London and Suburban Traction Co., Ltd. Trustees: Baring Bros. & Co., Ltd.

Julians of Reading, Ltd.—Capital, £5,000 in £1 shares. Return dated June 3rd, 1930. 2,403 shares taken up. £2,403 paid. Mortgages and charges, £6,000.

Bolton United Supplies, Ltd.—Capital, £100 in £1 shares. Return dated July 26th, 1930. 45 shares taken up. £45 paid. Mortgages and charges, nil.

Turner, Atherton & Co., Ltd.—Capital, £140,116 in 62,861 preference and 77,255 ordinary shares of £1 each. Return dated August 15th, 1930. 49,172 preference and 51,597 ordinary shares taken up. £26,487 paid on 19,228 preference and 7,259 ordinary shares. £74,282 considered as paid on the remainder. Mortgages and charges, nil.

City Notes.

The Third Central Board Issue.

On Monday last the Central Electricity Board invited offers for £6,000,000 of its 4½ per cent. 1951-73 stock at £95 10s. per cent. This is the third issue which the Board has made. The first was £3,000,000 of 4 per cent. stock at £83 per cent. in May, 1929, and the second £7,000,000 of 5 per cent. stock at £97 10s. per cent. in January last. The new issue will rank, *pari passu*, with these earlier amounts, and will be redeemed by a cumulative sinking fund commencing not later than the year 1937. The stock will be redeemed at par, in any event, on January 1st, 1973, but the Board reserves the right to redeem the stock at par on January 1st, 1951, or on any subsequent interest date. The proceeds of the issue are to be used to provide further funds for the construction and acquisition of main transmission lines, the cost of standardisation of frequency, and other authorised purposes, including the payment of interest out of capital during the unremunerative period of expenditure. The Board is empowered, with the consent of the Electricity Commissioners, to borrow £50,000,000, and the Commissioners have already given consents in respect of £23,000,000, including £5,500,000 for the standardisation of frequency. Thus, after the present issue, the Board is still left with unexercised borrowing powers to the extent of £7,000,000.

Although the lists were to remain open until Wednesday, if necessary, so great was the rush for applicaions on Monday that they were closed within a quarter of an hour. A very large proportion of the previous issues were left with the underwriters.

British Aluminium Co., Ltd.

Meetings of holders of preference and ordinary shares were held on November 21st to consider resolutions modifying the rights of the preference shareholders, adopting revised articles of association and increasing the capital of the company from £1,500,000 to £2,400,000 by the creation of 900,000 6 per cent. preference shares of £1 each. Details of the resolutions were given in the ELECTRICAL REVIEW for November 7th. Lt.-Col. S. H. Pollen (chairman), who presided, said that the first stage of the Lochaber works had been completed, and they considered it desirable that the final stages should now be completed, seeing that by a considerably smaller expenditure, compared with the initial outlay, the company would possess an installation providing about three times the present power. To carry out this plan and provide additional funds for other capital requirements it was necessary to raise further capital. The resolutions were approved.

John I. Thornycroft & Co., Ltd.

In the course of his speech at the annual meeting on November 19th, Sir John E. Thornycroft (managing director) said it was disappointing to have to report a reduction in overseas trade generally, and no one was able to forecast the break in prices of such products as wheat, wool, rubber, coffee, and tin. The effect of that break in prices on the purchasing power of the countries in which they were produced was well known, and shareholders would realise the effect on the company's business when he mentioned that their best markets abroad were Australia, New Zealand, Malaya, and Brazil. In Argentina and Uruguay they could report the opening up of a satisfactory business, and in South Africa also they had secured their share of the business placed. It was proposed to pay a dividend of 13 per cent. on the ordinary shares, the total in reserve being increased to £384,258. The report and accounts were adopted.

East India Tramways Co., Ltd.

The net receipts for the year ended July 31st last were £16,139, as compared with £14,177 in the preceding year. The preference and ordinary dividends are maintained at 5 per cent., and the deferred shares are to receive 10 per cent. (same), £716 being carried forward.

Radio Corporation of America.

The total gross income for the nine months ended September 30th last was $85,150,257, and the net income $870,753, which, added to the surplus at January 1st, makes a total of $30,560,997. Dividends on the "A" and "B" preferred stock for nine months' period required $3,900,400, leaving a surplus at September 30th of $26,660,597.

Buenos Aires Town and Dock Tramways, Ltd.

The gross receipts for the year ended June 30th last amounted to £188,031, as compared with £179,891 in 1928-29, and net receipts were £40,273 (£36,029). After deducting interest charges, &c., the net profit is £38,784. It is proposed to pay a dividend of 3½ per cent. (same), leaving £4,029 to be carried forward.

Tube Investments, Ltd.

The report for the year ended October 31st last shows a net revenue of £245,998, as compared with £225,053 in the preceding year, to which is added £70,652 brought forward, making £316,650 available. A dividend of 10 per cent. is again recommended on the ordinary shares, £75,000 is placed to reserve and £76,943 is carried forward.

Chloride Electrical Storage Co., Ltd.

An interim dividend of 5 per cent., tax free, is announced on the "A" and "B" ordinary shares (against 10 per cent.). The capital was increased in May last by the creation of 395,550 "A" ordinary and 112,907 "B" ordinary £1 shares, which were distributed among shareholders as a 100 per cent. bonus.

International Hydro-Electric System.

The gross revenue of the company and its subsidiaries for the year ended September 31st last was $50,403,916, and the net revenue amounted to $28,030,559. The balance added to the surplus is $3,812,847, making the total surplus for the year, after paying class "A" stock dividends, $14,359,287.

Stocks and Shares.

TUESDAY EVENING.

THE hesitation which has again crept over most markets has had no effect on that section of the House dealing in electric light and power securities where business continues to be quite cheerful and active. Although price movements have not been very numerous or large, when they have occurred they have practically all been in favour of holders. Bournemouths at 60s. 6d., City Lights at 35s., Counties at 50s., Electric Supply Corporation at 47s. 6d., London Electric at 32s., Yorkshire at 34s. 6d., Egham & Staines at 33s. 6d., Metropolitan Supplies at 43s., Northamptons at 45s., Electrical Distribution of Yorkshires at 36s. 9d., to mention only a few, were all fractionally harder. The various preference shares continue to be in exceedingly short supply and are standing at prices which show a yield, in practically every case, of not more than 5 per cent. The only two examples on offer at the moment are Bridgwater and District 7 per cent. preference shares 23s. 9d., giving a yield of £5 17s. 9d. per cent., and Egham and Staines 7½ per cent. preference at 27s. 6d., to yield £5 9s. per cent. These are, of course, two of the smaller concerns, but even in these cases there are only small parcels of shares available.

The outstanding feature of this market during the last few days was, of course, the issue of a £6,000,000 loan by the Central Electricity Board which came out over the week-end and was very heavily over-applied for. This issue took the form of a 4½ per cent. stock with a maximum life of 43 years, the price of issue being 95½. Other stocks of the Central Electricity Board are a 4 per cent. stock standing at about 86, and a 5 per cent. stock at 104, and in both cases there is very little stock about. Owing to the fact that the prospectus was available on Friday night and the list did not open until the Monday morning, the stags had a full week-end in which to exercise their talent. It is not yet known how many times the issue went, but in any case allotments will have to be drastically scaled down. Dealings are expected to start on Thursday round about ¼ premium. The price at which the stock eventuually settles down will, of course, depend upon the price ruling for British corporation and public body stocks. Another very interesting item was the placing privately of just over 500,000 Scottish Power 6 per cent. preference shares making the total issue up to a round million. Dealings here are expected to open round 23s. 6d. and, as at that price the shares compare very favourably with other 6 per cent preferences of a like character, they are likely to meet with a very good reception. The South London Electric Supply Corporation has also placed, privately, £300,000 4½ per cent. debenture stock. A certain amount of this is now available at 95, free of stamp and fee, and, as the interest is covered very nearly 10 times over, it will doubtless be quickly absorbed.

Interesting statistics have been compiled by a House firm showing the position of an investor who purchased 100 shares of some of the principal lighting undertakings in 1924 and took up his new shares as they came out from time to time. In every case the investor is to-day in a very happy position, as will be seen from the following extracts which we give showing the yield obtainable on the money invested based on the rate of dividend for 1929, and also the profit, expressed in percentage, if the holding is sold at to-day's price.

	Yield per cent.	Profit per cent.
Clyde Valley	7	49
County of London	10	117
Metropolitans	8½	68
Midland Counties	6¼	25
Newcastle-upon-Tyne	5¼	18
Scottish Power	6 5/16	18
Urbans	9¾	91
Bournemouths	13¼	169

Interest is growing in the securities of the West Gloucestershire Power Company in view of the very great increase in output which is being achieved by this concern. For the first 10 months of the current year the energy sold has shown an increase of nearly 90 per cent. over the first 10 months of 1929. This compares with an increase of between 5 per cent. and 6 per cent. for the whole country. As a result persons who are willing to wait dividendless for a few years have been absorbing the preference stock at about 75 and the ordinary stock at about 50: the 5 per cent. debenture stock was also sharply marked up to 104. Quite a large parcel of London Power 5 per cent. debenture stock changed hands during the week at 103¼, and buyers were paying 104½ for County of London 5 per cent. and Yorkshire 5 per cent stocks. The debentures of this group are—like the preference shares—in exceedingly short supply, and the only one on offer at the moment is Edmundsons' Electricity 5 per cent. debenture stock, where some £10,000 provisional scrip is available at 100½. Taking into account the fact that there is a broken interest of £1 16s. 4d. per cent. payable on January 1st, the yield is a few pence over the 5 per cent. mark. In the holding group Atlas Electric and General ordinary were marked down to 22s. ex dividend, and the preference at 25s. 4½d. were also ex dividend. British Power & Light remained unchanged at 14s., and Whitehall Electric Investments 7½ per cent. cumulative preference were on offer at 25s. 6d. Of recent issues Scottish Power new ordinary did not succeed in retaining all their previous rise and were fractionally down at 28s. 9d.: Midland Counties new, however, are fully up to their best at 3s. 3d. premium middle. The securities of the companies operating overseas threw up no feature worth recording: Perak River Hydro-Electric 7 per cent. debenture were again marked down to 84, in sympathy with the continued bad state of both the tin and rubber industries, but the ordinaries kept around their previous level of 6s. 6d. About the only one of the Indian group of lighting concerns to be seen was Calcutta Supplies which were harder at 47s. 3d. The preference shares continue in investment demand round about 21s. 6d. British Columbia Electric Railway preference marked up to 96½ in sympathy with all fixed interest stocks, but the "A" and "B" stocks of the holding company, British Columbia Power Corporation, continued to be very uninteresting round about their previous level.

Home Railways React.

The recent small rise in the equities of the Home Railways has not been held and the market has again fallen back into a very uninteresting state, the only exception being Underground Electric ordinary which have risen to 24s. 6d. on belated appreciation of the continued excellent traffics of the Underground group. This appreciation, however, has not yet spread to the tramway operating companies, where there are no changes to record. British Electric Traction deferred is again better at 1425, and the preferred ordinary retained its previous rise to 127½. Of the subsidiaries of the B.E.T. the 6 per cent. cumulative redeemable preference shares of the Birmingham and District Investment Trust are on offer at 20s. 3d., and there is a parcel of the recently issued Hants and Dorset 6½ per cent. cumulative £1 preference available at 21s. 1½d., free of stamp and fee. Calcutta Tramways were dull on the continued bad traffics, but Burmas hardened up to 11s. on the maintenance of the 5 per cent. dividend and the slight increase in revenue for the year ended July last.

Cables and Wireless Dull.

The three securities of the Cables & Wireless merger sagged off further upon the publication of the estimated traffic receipts of the operating company, Imperial and International Communications, Ltd., for the month of October, which showed a drop of 13¼ per cent. over the corresponding month of last year. This is against an average drop of 11¼ per cent. for the first 10 months of 1930, as compared with the first 10 months of 1929, and it is not very cheerful reading, especially as these receipts are considered by many competent observers to be a barometer of current trade. As regards the electrical manufacturing group as a whole, the best that can be said is that it was steady. Both Associated Electrical Industries and G.E.C.'s continued to move within very narrow limits, but the recently-issued 5 per cent. debenture stock of the G.E.C. remained in investment demand and is now unobtainable under 102½. Siemens were marked ex dividend at 21s. 3d., at which price they yield over 7 per cent. on last year's rate of distribution and would appear to be one of the cheapest ordinary shares of the group.

General.

The gilt-edged market continues to monopolise the major portion of the attention of the investing public and prices continue to creep to higher levels, although one does not hear quite so much of the imminence of a conversion scheme for the £2,000,000 5 per cent. War Loan. The lack of any sign of a marked improvement in industry not only at home but all over the world is likely to cause investors to keep to safety-first tactics for some time to come, and there is every reason to suppose that business will continue to be concentrated in gilt-edged and kindred stocks, and as a natural corollary the miscellaneous market as a whole is likely to remain in its present friendless state for some little time to come.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend. 1928.	1929.	Price Nov. 25 1930.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	3⅝	+⅛	4 19 2
Brompton Ordinary	1	8½	8½	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	28/6	+6d.	5 14 0
do. do. 4½% Pref.	1	4½	4½	18/-	—	5 0 0
Chelsea	1	8½	8½	27/-	—	5 8 8
City of London	1	10	10	35/-	+6d.	5 14 3
do. do. 6% Pref.	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	26/3	—9d.	4 8 3
County of London	1	7	10	50/-	+2/-	4 0 0
do. do. 6% Pref.	1	6	6	24/6	—	4 19 6
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	47/6	+6d.	4 18 7
Kensington Ordinary	1	8	8	27/6	—	5 1 10
Lancs. Light and Power	1	7½	7	25/-	—	5 12 0
London Electric	1	8½	9	29/-	+6d.	5 12 6
Metropolitan	1	9	10	2¼	—	4 14 1
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	7	28/6	—	4 18 3
Mid. Elec. Power	1	15	8	31/8	—	5 2 5
Newcastle-on-Tyne Ordinary	1	6	6	23/9	—	5 1 0
do. 7% Pref.	1	7	7	27/6	—	5 1 10
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 4
North Met. Elec. 6% Pref.	1	6	6	23/6	—	5 2 2
St. James' and Pall Mall	1	8	8	28/-	—	5 0 0
Scottish Power	1	8	8	30/-	—	5 6 8
South London	1	8½	8½	27/-	—	5 8 8
Urban Ordinary	1	7	7	29/6	—	4 15 0
Westminster Ordinary	1	8½	8½	28/-	—	6 0 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	34/6	+9d.	4 12 9

HOME RAILS.

Central London Ord. Assented	Stock	4	4	79	—	5 1 8
Metropolitan	,,	8½	4	69½	—	5 15 1
do. District	,,	4	5	76½	—	6 10 9
Underground Electric	£1	7	8	24/6	+6d.	6 10 8
do. do. Income	Bonds	6	6	104	—	5 15 5

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 7
do. Def.	,,	1½	1½	25½	—	5 17 8
Automatic Telephone	1	10	12½	35/-	—	7 8 4
Cables & Wireless 5½ Pref.	Stock	—	5½	72½	−1	7 9 8
do. A 7½ Ord.	,,	—	—	22½	−2	... ...
do. B Ord.	,,	—	—	12	−1	... ...
Globe Tel. and T. Ord.	10	10	10	14½	—	6 18 0
do. do. Pref.	10	6	6	10½	—	5 11 7
Great Northern Tel.	10	20	20	30	—	6 13 4
Marconi-Marine	1	12½	15	17	—	8 0 0
Oriental Telephone Ord.	1	12	12	25	—	*5 1 1

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	14	—	14 13 4
do. do. 2nd Pref.	5	6	6	12	—	17 8 0
do. do. 5% Deb.	Stock	5	5	50½xd	−2	9 19 0
British Electric Traction Def. Ord.	,,	5	5	1425	+25	... ...
do. do. Pref. Ord.	,,	8	8	127½	—	6 5 8
Brazil Traction	100	7	8	26½	−½	... ...
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	96½	+1	5 4 0
London & Sub. Trac. 5% Pref.	1	Nil	Nil	11/-	+6d.	... ...
London United Tram Deb.	Stock	4	4	54½	—	7 6 10
Mexico Trams, 5% Bonds	—	5	5	59	—	8 9 6
Mexican Light Common	100	Nil	Nil	50½	—	... ...
do. 7% Pref.	100	7	7	73½	−1	9 8 0
do. 1st Bonds	—	5	5	78	—	6 6 7
Victoria Falls Ord.	1	15	15	58/9	—	5 2 0
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

Assoc. Elec. Ord.	1	6	6	23/6	—	5 16 8
Babcock & Wilcox	1	13	15	52/6	—	*5 14 3
British Aluminium Ord.	1	10	10	43/9	−2/-	5 18 6
British Insulated Ord.	1	15	15	3½	—	4 5 9
Brush Ord.	Stock	10	10	105	—	9 10 6
Callenders	1	15	15	3½	—	4 12 4
do. 6½% Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	5/-	—	90	30/9	—	7 4 7
do. 8% Pref.	1	8	8	26/3	—	6 2 0
Edison-Swan 1st. Pref.	1	7½	7½	23/9	—	6 6 4
do. 5% Deb.	Stock	5	5	83½	−1	6 19 8
Electric Construction	1	5½	5	12/-	—	8 6 8
Enfield Cable Ord.	1	20	25	4½	—	5 17 9
English Electric	1	Nil	Nil	11/3	—	... ...
do. do. Pref.	1	8	Nil	10/-	—	... ...
Ferranti Pref.	1	7	7	21/-	—	6 9 6
Gen. Elec. Pref.	1	6½	6½	26/3	—	4 19 1
do. Ord.	1	10	14	46/3	—9d.	6 0 6
Henley	1	25	30	6	—	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	6/3	—	... ...
Johnson & Phillips	1	10	10	1½	—	5 6 8
Siemens Ord.	1	7½	7½	21/3xd	—9d.	7 1 2
Telegraph Construction	19	10	10	17½	−1	*6 18 0

* Dividends paid free of Income Tax.

The B.E.A.M.A. Dinner.

Sir Hugo Hirst and Imperial Industrial Co-operation.

THIS year's dinner of the British Electrical and Allied Manufacturers' Association, held at the Connaught Rooms on November 19th, was a greater affair than ever before. The presence of so many distinguished men, in the gathering of about 750 people, evidenced the general recognition of the importance of the electrical manufacturing industry and its Association.

Lord Derby, president of B.E.A.M.A., again adequately occupied the chair. After the loyal toast had been honoured, **Sir Hugo Hirst,** Bt., rose to propose the toast of "The Electrical Industry and Co-operation Within the Empire."

Electricity and the Empire.

Sir Hugo said that although at the present time the electrical industry, as regarded production and exports, could probably not be compared with our older staple industries, the view might justifiably be taken that before another generation passed it would play a dominant part, even from the point of actual figures. But even more important was the part that it was destined to play in the consolidation of the Empire. At the conclusion of the war he (Sir Hugo) had prophesied that as the steam engine had enabled the country to recover from the effects of the Napoleonic wars, so would the electrical unit help the country and the Empire to recover from the exhaustion of the world war. Although at the time the parallel might have seemed too visionary for realisation, he thought that it would be more acceptable to-day. Now the fullest use of electric power was regarded as an essential to efficient production and the older industries underwent a process of rejuvenation when they were electrified. Next to efficiency electric power had the advantage of mobility. That would enable industries to be started on sites where raw materials were being produced and tend to lead to a healthier distribution of the Empire's population. Moreover, electricity had set up, in a sense, a new standard of living, and electrical service was more and more recognised as essential to a civilised existence. From the Empire point of view, the greatest part which electricity would have to pay was in the fields of transport and communication. By electric ship propulsion and by electric traction, electrical engineers were overcoming the handicap of space and saving time. It was already possible to communicate with the greatest ease and clearness with the principal parts of the Empire and soon such facilities would be available on a commercial basis to all the citizens of the Empire.

Current and Future Developments.

British electrical manufacturers claimed to have done all that was humanly possible to develop their industry to the highest pitch. They had surmounted the handicaps imposed upon them at the start, and during the war had built up a comprehensive and up-to-date industry. For five or six years after the war they enjoyed the patriotic support of public opinion. The accepted principle was that British industry must come first if our standard of living was to be maintained in the face of competitors working on much lower standards. During that period the industry developed the biggest electrical exporting business in the world, and provided good service for the home consumer. Now, however, the importation of electrical goods which could be made in this country had risen to an alarming extent. While the Central Electricity Board was loyally spending the thirty-four millions granted by Parliament with British producers, the foreign producer was beginning to enjoy the principal benefit of the Grid scheme. If that flow of goods remained unchecked for long it could not but affect the stability of the industry and its ability to serve the Empire. Protection of labour was impossible unless it was accompanied by the protection of the products of labour. He emphasised that so far as the electrical industry was concerned safeguarding would mean lower, not higher, prices. Already they were selling commodities protected by patents 40 or 50 per cent. cheaper than before the war. They were conscious of the fact that the lowering of prices broadened the market and consequently their aim was to reduce prices. The industry had done all that it could to help itself; it now looked to the State to provide the needful measure of defence. Empire countries were already our best customers, but in the future their development would be greater and they would look to us to supply their electrical needs on an efficient basis. But they also wanted to enter the manufacturing field themselves. Although at first sight it appeared insoluble, he believed that the solution could be found to the question of reconciling our interests as an established industrial country, with a large number of unemployed, with the ambition of the Dominions to manufacture instead of buy from us. His studies in Australia showed him that the Commonwealth with its small population could not establish and maintain a large, comprehensive electrical manufacturing industry. But there were certain branches in which Australian manufacturing could be economically justified. Already it had been decided by the principal importers of electric lamps that a factory could be established in Australia, and similar arrangements were being studied in connection with thermonic valves and with certain types of cables and wires. In addition, various specialist electrical manufacturers had linked themselves with Australian producers, giving them the encouragment of British capital and technical skill and research. In his opinion those were the lines on which the electrical and other industries must proceed if we were to bring the industrial development of the Dominions within a unified scheme. The Dominions had indicated that in return for those services we might expect special preferences for all goods which they could not produce economically and which we were able to produce. But, however efficient, those trade arrangements could not produce the final result of "Empire rationalisation" unless they were supported by Government action—probably agreements between the Mother Country and the Dominions, granting protection or preference, so that "Empire" industries should be allowed to develop and prosper. In this connection, they asked for a uniform policy, frankly declared and logically applied.

An "Economic Sub-Parliament."

The **Rt. Hon. Winston Churchill,** responding to the toast, said that it was significant that Sir Hugo Hirst had made a plea for the protection of what was a comparatively prosperous industry producing highly-finished articles. That, of course, would involve the protection of all the constituents down to the crudest raw material. Although the subject of protection had not yet been fully thrashed out and decided upon by an impartial judge, he believed that there existed a strong current of opinion in favour of it. Since the war political problems had given way to grave economic problems, and however satisfactory the party system was politically it was unsuitable for the settlement of those problems. We were living in a condition which was the most artificial that had ever existed in a state of our size and we could not afford to allow it to continue. Were the three parties actually doing their best for the people of this country? He could not but feel that other countries had a far better grasp of the situation than we had. What machinery existed in this country for weighing up the questions which Sir Hugo Hirst had raised, with patience and sanity? There should be a responsible and constructive body to deal with such matters. Our Parliament was the best in the world politically, but it was totally unsuited for dealing with the economic issues in which grave doubt existed. We ought to set up proper machinery for the purpose; it could not be done on party lines. He suggested what might be called an "Economic Sub-Parliament" to sit with the existing Parliament. It should be mainly expert, but there should be a proportion of the present political Parliament in it. The body would be chosen by the party leaders in proportion to the parties' strength. It could be given greater powers than Royal Commissions and committees and its task would be to examine and pass judgment upon all Parliamentary economic measures. It could also have the power to frame Bills for which a definite proportion of Parliamentary time would be reserved. Thus we should obtain the best advice from people who had no axe to grind.

Mr. Morrison on Electrical Development.

Sir E. Hilton Young, M.P., proposing the health of the guests made particular reference to the presence of Sir Ernest Rutherford, Pres. R.S., Mr. G. M. Gillett, Parliamentary Secretary of the D.O.T., Sir William Bragg, Sir Herbert Walker, general manager of the Southern Railway, Sir Andrew Duncan, chairman of the Central Electricity Board, Sir John Brooke, Electricity Commissioner, and Mr. C. C. Paterson, Pres. I.E.E.

Mr. Herbert Morrison, Minister of Transport, replied to the toast. He said that Sir Hugo Hirst's speech was worthy of the serious attention of politicians and industrialists alike. Such men who had built up great national industrial undertakings deserved the honour and respect of their country. He always enjoyed Mr. Churchill's speeches, but he had particularly appreciated that evening's speech, for Mr. Churchill had left party politics behind. Mr. Churchill was wise to warn electrical manufacturers that protection of their industry would involve the protection of their raw materials. Undoubtedly, economic matters should be considered in a non-

political way, but it was very difficult to bring that about. Political opposition was good for Ministers; it kept them alive and made them careful. A Minister who succeeded was he who had the courage to stand by what was right, and generally he got through safely. He urged electrical manufacturers not to be content with being interested in manufacture only, but in electricity supply as well. If that end of the business was not carried out properly the manufacturers had to suffer. Electricity supply had made a tremendous advance through the co-operation of manufacturers, supply authorities, the Commissioners, and the Central Board. The Central Board had an economic and business function and politicians did not interfere with it. He hoped to set up a similar body to reorganise the London transport services. Electricity had grown up on a local basis, but now, if full development was to be achieved, it had to be placed on a national basis. By publicity and assistance to the consumer it would be possible to bring electricity to every urban house, every rural village, and every farmer. In spite of the difficult conditions, electricity supply had continued to go ahead—so had the gas industry, which presented an example to be admired and emulated. The cost of electricity generally was still too high; the undertakings must produce attractive two-part tariffs and free or rental wiring schemes if full use was to be made of electrical service. He asked the industry to risk a little capital expenditure in advance of the demand.

The Chairman.

Mr. V. Watlington, chairman of the Council, in proposing Lord Derby's health, referred to the loss sustained by the B.E.A.M.A. in the deaths of Dr. S. Z. de Ferranti and Sir Benjamin Longbottom. He spoke in glowing terms of Lord Derby's services to the Association, and said that they desired the Association to earn a name for honesty and single-mindedness of purpose, such as their distinguished president bore.

Contractors' Supplies for China.

A Large, but Competitive, Market.

THE Department of Overseas Trade has recently prepared for the information of British manufacturers and traders a report upon the Chinese market for electrical contractors' supplies. In the first place, the nature of the materials used is treated, and it is said that there are no fixed wiring regulations in China. The various power companies make their own rules, and in the case of Shanghai these are practically based on the I.E.E. Regulations. It is thought that the Chinese Government will draw up a code in course of time. Many systems of wiring are employed, the order of their popularity being as follows: Rubber-insulated wire on cleats; r.i. wire in wood casing; lead-covered wire for better-class buildings; and conduit in important buildings. A meter of British manufacture is popular, but there is reason to believe that Germany and Switzerland are doing a good business in this direction. Porcelain ceiling roses of Japanese manufacture are largely used. Although the Americans have made an effort to popularise the Edison screw lampholder the bayonet pattern is still in greater favour. Rotary, tumbler and push-button switches are all employed, the tumbler apparently being the most popular. Wall plugs are usually of the two-pin pattern in 5, 15 and 25-A sizes.

Competition.

Electrical contractors' supplies may be said to fall into two categories: (*a*) for use in the interior on the mains of the smaller Chinese supply companies, and (*b*) for use in the Treaty Ports and by the larger Chinese supply companies in the larger ports, such as Nanking, Amoy, and Hankow. Class (*a*) demands the cheapest goods possible; British goods are almost ruled out by price, German and Japanese goods commanding the market. In class (*b*) there is scope for British goods. In power and lighting cables a number of British firms are already in the market doing a fair business. Similarly, a good deal of British conduit is sold, though makers complain of low prices owing to the risk of German competition. This business is likely to decline, as Chinese interests have recently begun to manufacture conduit in Shanghai. The quality is not up to British standard, contractors complaining that the interior is rough, but prices are very much lower. British makers will find a fair demand for ironclad cut-outs, but little request for round fuses or distribution boards, as both are made in Shanghai. British ceiling-roses and lampholders cannot be sold in China, as prices are about twice as high as German prices, and the German product is fairly serviceable. The demand for British switches, wall plugs and sockets is also limited. For certain expensive buildings architects sometimes specify British switches, but by far the greatest share of this business is secured by the General Electric Co. of America, which has a local factory manufacturing the porcelain parts, which enables them to underquote British makers by about 50 per cent. In fittings and shades, British makers are handicapped by price, and most of this business is obtained by Continental and American firms.

Authoritative Review of the Position.

The report includes a number of observations on the market for electrical machinery and apparatus in China (particularly Shanghai) from an expert attached to one of the largest power companies, who is said to be well able to judge the efforts of competing manufacturers of different nationalities to obtain business in the Chinese market. While the observations have more especial reference to power station equipment, it is evident that they apply to some extent to contractors' supplies. The extent of the market and the sources of supply of electrical machinery and apparatus in Shanghai is probably wider than anywhere else in the world. There is a large concentration of manufacturers' representatives and agents of all nationalities, all of whom are keen to secure business, and the potential purchasing power of the country is such that business is accepted upon terms which take more thought of propaganda than profit. Trading methods are diverse. In some instances the parent firm is represented directly by its technical employés occupying their own offices and maintaining an appropriate staff. In other instances, local representative houses are appointed and their efforts are supported by a resident representative of the parent firm who holds a "watching brief" so far as his employers are concerned and acts in a consultive capacity to prospective clients. The method of appointing agents who work entirely independently is also utilised. The carrying of stocks, consignment or otherwise, is generally held down to a minimum, owing to the indefinite factors introduced by exchange fluctuations. In the case of competitive dealing, it is usual to seek "c.i.f. destination" figures in order to place the quotation upon a competitive basis in respect of freight charges. The practice of seeking quotations in gold currency is favoured, inasmuch as it eliminates the necessity of providing for exchange fluctuations.

It is considered that British representatives are the least energetic in putting forward that which they have to offer. The practice whereby manufacturers enter into arrangements as to representation with large local firms whose activities cover a very wide field would appear to be very debatable. Furthermore, there is a growing tendency on the part of large firms handling a number of agencies to adopt a "take it or leave it" attitude, as compared with the close "follow up" methods generally utilised by American and Continental firms. In the case of some of the larger British engineering firms a state of uncertainty prevails owing to reorganisation and amalgamations which are taking place. With regard to local competition or growing strength of attack, there would not appear to have been any material change in this respect during the past few years. Exception might perhaps be made in the case of certain Continental houses which have elected to accept business upon a basis of long-term credits which appear to be fantastic, but are doubtless entered into for the sole purpose of propaganda.

Methods of Opening Up Trade.

It is thought remarkable that a number of leading British engineering concerns are unrepresented in China at the present time. There would not appear to be any reason to suppose that the Customs regulations will prove unduly irksome.

A study of the conditions prevailing over a number of years leads one to the conclusion that the British manufacturers are not taking full advantage of the present favourable economic conditions which prevent the American manufacturers from being able to quote upon a keenly competitive basis in many directions. The somewhat chaotic conditions in the British manufacturing world have given rise to frequent disappointment and annoyances so far as the purchaser is concerned, and the state of uncertainty which exists in the minds of representatives and agents as to the final intentions of their principals must react in the wrong direction. The output of descriptive literature from the British manufacturer is very small as compared with the efforts of other countries. It is an undeniable fact that the superiority of British manufacturers is ignored and the choice of tenders is, apart from questions of sentiment, mainly a matter of cost.

Electricity and the Public Mind.

The Second E.D.A. Conference of the 1930-31 Session.

SUGGESTIONS of ways and means of improving relationships between the electrical industry and members of the community whose mental attitude, as potential consumers, could make or mar its prosperity, were put forward by **Mr. S. Francis** (E.D.A.) at the November conference of the British Electrical Development Association in London on November 21st. The subject of his paper was "Electricity and the Public Mind." **Mr. E. Slater** presided.

In the first part of the paper the author dealt with the changing commercial and industrial outlook, and emphasised that if the situation were tackled intelligently and courageously, there was no reason why electricity, as the power of the future, should not emerge from this period of stress with enlarged scope and renewed vigour. With the exception of certain forms of electrical production which lent themselves to export, large sections of the electrical industry would be increasingly dependent upon the home market, so that the development of the home market was vital. The supply industry must be in constant readiness to meet the public needs, and the picture of the industry as a great public service standing always at the disposal of the community was one of which the public must be made more and more definitely aware. There existed a real need to cultivate a genuine interest on the part of the public in the functions which electricity should perform in their lives, and a real public understanding of the part that it should play in helping to re-shape the civilisation of our time. Electrification was not a process that would grow by itself; it would arrive only as the result of a widespread conviction that electricity was the safest, cleanest, and most effective power, heating, and lighting, agent.

It being his view that it was probably in the domestic and agricultural spheres that a policy of educational penetration was most strongly needed—for the forces of inertia and conservatism were strongest in those spheres—he urged as a first step to the creation of a satisfactory domestic load the formation of certain habits of mind, not only on the part of householders, but also in building contractors, town planners, and persons who served on public bodies. The numbers of excellent houses that were being built, complete with modern conveniences in the way of heating, sanitation, plumbing, &c., but with inadequate electrical installations, was the result of imperfect knowledge of the possibilities of domestic electrification. Among the obstacles to be overcome was the still prevalent idea that electricity was expensive; there was much to gain by showing the less well-informed members of the public how illusory the idea of electric "dearness" was, and how real the idea of electric "usefulness" could be. Another obstacle was the fear engendered in many people through hearing of rare cases of fatal electric shocks, or fires. A widespread policy of educational propaganda was needed to dispel this fog of ignorance and fear. Mr. Francis suggested that the tendency to neglect the ear and to give preference to the eye as a channel of approach to the public mind resulted in weakening the appeal. Both these channels of approach should be used to the full. Owing to the ease with which machines could multiply the printed message, the appeal through the eye could be more easily broadcast, but what it gained in breadth it lost in depth, as it was deprived of the effect that might be produced by personal contact. He appealed for a broad, comprehensive "super-policy" within which every form of electrical publicity could pull its full weight, with a minimum of overlapping, and a maximum of co-operation. Within the framework of such a policy, public and quasi-public lectures, plain and illustrated, provided extremely effective methods of telling the public something of the romance and social importance of electricity, as well as conveying direct information of its advantages to the individual. Lectures must not be regarded as a means of training the public to become electricians, but should create in their minds a desire for electricity, or some use of it in particular, and stimulate the will to satisfy that desire, and so assist the approach of the salesman. It was dangerous to over-tax the normal mind, the saturation point of which was easily reached, and Mr. Francis emphasised that if an audience left a lecture suffering from mental fatigue their feeling of annoyance with the lecturer might easily be transformed into a dislike of his subject. Those responsible for the guidance of the electrical industry should encourage, and, in fact, should make possible the finding and training of the men and women able and willing to give lectures.

The competition of popular places of amusement had rendered increasingly difficult the task of getting audiences by inviting the public through posters, advertisements, circulars, &c., to attend such lectures, though quite useful meetings could still be organised in this way where the circumstances were favourable. The organisers of local religious, political, social, cultural and trade bodies, however, often welcomed offers of lectures to their members so long as the lectures did not conflict with the express purpose of the organisations, and provided the matter was suited to the type of audience provided. Associations of professional and business men might also be induced to receive lectures on the application of electricity to their professions or trade activities, and valuable work might also be done by delivering suitable lectures to the senior pupils, of both sexes, in the schools. The value of lectures in the showrooms or demonstration rooms of electricity undertakings, especially if the more general methods of advertising were supplemented by personal invitations to known consumers and by circular invitations to selected organisations, was also emphasised.

In conclusion, Mr. Francis said that electrical power, wisely directed, and developed with imaginative foresight, might easily form the basis of civilisation more healthy, happy and spacious than any the world had yet known, but this consummation depended jointly upon the vision, the wisdom and the skill of those working within the industry, and the sympathetic acceptance of their work by an appreciative public.

Discussion.

Opening the discussion the **Chairman,** after commenting upon the manifold blessings of electricity and its mighty power for good, said that if it had been known in its present form to the Romans they would have deified it.

Mr. Selly (Marylebone), who testified to the valuable effect of the lectures that Mr. Francis had delivered throughout the country, said that questions which were put to electrical men from time to time could be traced back to those lectures. The idea of cheap electricity under the two-part tariff system was permeating the public mind. In his view the public knowledge of the use of electricity was growing.

Mr. H. R. Summers urged that supply undertakings should not be satisfied with the amount of business they were doing, and consider that there was no need to advertise, for the field for electricity was enormous.

Mr. W. R. Rawlings emphasised the need for public education. He suggested that the electrical Press would do more good than at present if it wrote for the public and not merely for the people in the industry, or that it should publish a journal to interest the general public in electrical matters. He advocated a decrease in the prices of electricity as a valuable means of advertisement, and criticised the reluctance of undertakings to provide mains without payment, unless a minimum consumption was guaranteed.

Mr. Kennedy caused much amusement by recounting a recent experience he had had when lecturing to an audience of domestic science teachers, all of whom had come from secondary schools. His statements regarding the small cost of toasting and ironing by electricity had been received with a titter of incredulity, but his audience had become more serious as he had continued to talk, until ultimately their attitude was one of semi-annoyance because they had never been informed of these matters before, but had always been told that electricity was expensive.

Miss Ellis attributed much of the inadequate wiring of houses to the ignorance of architects and builders and their unwillingness to co-operate with electrical contractors.

Mr. Calvert was concerned about the difficulty of selling apparatus in the face of the high prices charged for electricity in some districts, and said that unless the shareholders of some electric supply companies realised the position we should not get very far with the general electrification of households.

Lieut.-Col. W. A. Vignoles (director of E.D.A.) said that the industry itself realised that the prices of electricity were too high in some cases, but, at the same time, it was the fact that about eighteen months ago about 70 per cent. of the population of the country lived in areas in which they could obtain electricity, on the two-part tariff, at 1d. per kWh (which was not unreasonable) and about 30 per cent. could obtain it more cheaply. Discussing the training of lecturers, he said that if anyone in the industry required assistance in improving their methods of lecturing, Mr. Francis would be glad to help them. In London and the Southern Counties E.D.A. had concentrated during the last few years upon audiences connected with rotary clubs, chambers of trade, and so on, but in the north Mr. Francis was getting large audiences by advertising lectures as such. With regard to architects, the E.D.A. had prepared the "Home Specification" to indicate how houses should be wired, and the architects had welcomed it.

Mr. C. H. Dobell suggested the cinema film as a valuable medium for telling the public the electrical story.

Mr. Francis, in his reply to the discussion, emphasised the value of personal contact between audience and lecturer, and said that radio, "talkies," and gramophones were not so good substitutes for the direct human voice.

Indian Electrical Notes.

(By Our Indian Correspondent.)

Rural Electrification.

THE Government of Bombay has been considering for some time past the question of supplying electric power to rural areas. In this connection, the electrical engineer to the Government during his last visit to Europe was asked to go to Switzerland, Norway, and Sweden and see the use made of hydro-electricity by small industries in those countries. He was also asked to examine after his return the question of making electricity available to small industries in the Bombay Presidency in those areas especially through which the transmission lines of the Tata Hydro-Electric Companies are passing. His report was considered by the Government and decisions will be made shortly.

The areas through which the transmission lines pass may be specified as Bombay City, rural townships, and other rural areas. The Bombay City area may be considered well served in the matter of electricity, although it is complained that the power rates charged are high. As regards rural townships, the towns of Kalyan, Thana, Lonavla, Khandala and Poona are well supplied, and schemes are also in hand for the supply of bulk power for distribution in Panvel and Bhivandi. It is also understood that arrangements are in progress to supply energy in bulk to other important towns, such as Talegaon and Pen.

Small Power Plant Preferred.

The present charges levied by the Tata Hydro-Electric Companies for supplying energy in bulk in rural areas are about 1.25 annas per kWh for the first 13,000 kWh, and one anna per kWh for the next 40,000 kWh. Keeping in mind the cost of distribution and transmission, it is doubtful if energy could be sold to small industrial establishments at anything substantially under 2.5 annas per kWh. As against this, the cost of power to a small factory which has installed its own power plant may be about 1.5 to 1.75 annas per kWh. There is considerable room for reduction in cost of energy to small industries before the latter can find it advantageous to utilise it.

It is understood that each outdoor single-phase sub-station for transforming 100,000 V (the pressure of the Tata lines) to 2,200 V and making available about 100 h.p. will cost about Rs.65,000. A similar three-phase outdoor station making available about 200 h.p. will cost about Rs.110,000. In addition to the cost of sub-stations there would be the very considerable cost of transmission and distribution lines.

From this it is clear that, if it were considered essential to make power available to small factories in the rural areas, this purpose would be much more cheaply fulfilled by advancing loans on easy terms for the purchase of small individual power plant than by embarking on the establishment of sub-stations scattered at different points and erecting transmission and distribution lines.

Electric Lighting in Calcutta.

A scheme for a power station for the lighting of some important areas of Calcutta has been prepared. By selecting suitable power and lighting loads from the requirements of the Calcutta Corporation, it has been possible to evolve an almost ideally economic project due to making the load factor as high as 90 per cent. The capital cost of the three schemes comprising the whole project is realisable in two years from the electricity bills annually to be paid by the Corporation.

Under scheme (*a*) it is proposed to supply energy for pumps in the Bagh Bazaar Metal Depôt, where the plant will be housed. In scheme (*b*) provision has to be made to supply electrical energy to particular areas. Scheme (*c*), which deals with street lighting, will also include provision for supplying energy to the Entally workshops and the Motor Vehicles Department workshops. It will consist of (i) a h.p. underground cable from Tallah to Sealdah station, which will be tapped at different points, the energy being transformed to a medium pressure by means of outdoor transformers; and (ii) a l.p. distribution line for linking up the existing electrified areas and for lighting the Upper Circular Road, Harrison Road, Cornwallis Street, &c. A special committee has been appointed to consider the scheme.

Electrical Imports.

The imports of electrical machinery during the six months from March to September amounted in value to Rs. 113 lakhs, against Rs. 124 lakhs in the corresponding period of 1929. The decline in the share of the United Kingdom (90 lakhs) was only Rs. 2 lakhs. The greatest decline occurred in the case of the United States of America, whose share fell from Rs. 12 lakhs to Rs. 7 lakhs. Germany's share rose from 8 lakhs to 10 lakhs. The various classes of machinery did not show much fluctuation. Control and switchgear stood at about Rs. 20 lakhs. Generators, &c., increased from 19 lakhs to 23 lakhs. Motors declined from Rs. 23 lakhs to Rs. 21 lakhs, and transformers from 7 to 8 lakhs. Turbo-generator sets declined by about 1 lakh to Rs. 2¼ lakhs.

Imports of electrical goods declined from Rs. 172 lakhs to Rs. 156 lakhs, the share of the United Kingdom falling by Rs. 13 lakhs to Rs. 89 lakhs. The shares of other countries also declined; Germany's from 20 lakhs to 19 lakhs, that of The Netherlands from 9 lakhs to 7 lakhs, and that of Italy from Rs. 7 lakhs to Rs. 4 lakhs. Japan's share increased by about 1 lakh to Rs. 4 lakhs, while the share of the United States stood unchanged at Rs. 21 lakhs. Radio apparatus also declined from Rs. 328,000 to Rs. 261,000, the United Kingdom's share being Rs. 134,000, against Rs. 200,000 in the corresponding period of the previous year.

Reducing Accidents in Industry.

A Study in Practical Psychology.

ACCIDENTS to employés form a frequently unsuspected source of industrial loss, and, quite apart from any humane considerations, it is a sound business policy to take every possible step towards their elimination. Much valuable work has been done in this direction by the National Institute of Industrial Psychology, and the Director of the Institute, Dr. G. H. Miles (formerly Assistant Director), recently gave a very interesting lecture on the subject. The lecture—"The Psychology of Industrial Accidents"—was delivered under the auspices of the National Institute of Industrial Psychology and the London Safety First Council (Industrial Section), the chair being taken by Sir Felix Pole.

Dr. Miles pointed out that the question of accident prevention in industry was an extremely complicated problem which must be approached from many different angles if satisfactory results were to be achieved. Whatever might be the apparent reasons, the real causes of accidents were distinctly complex. Broadly speaking, however, two distinct sets of phenomena were at work, one comprising defects in the machinery and equipment, and the other representing the human factor; and of the two, the human factor was by far the more important.

Considerable attention had already been paid to mechanical equipment with a view to reducing accident risks. There was, however, still much more to be done in that direction, although the larger proportion of industrial accidents was attributable to causes which could not be prevented by physical safeguards. In particular, it was felt that design engineers should pay more attention to the conditions under which their machines were to be used. This would result in improvements in the ease of control, leading to a reduction in general fatigue, and in a reduction in the time taken in reacting to a dangerous situation. Consideration should also be given to the provision of more efficient personal protection in the shape of goggles, glasses, heat- and fire-proof clothing, and the provision of better guards on machines and drives to reduce the possibility of accident. In that connection, however, it should be appreciated that if the safety device was such that it hindered the operator, there would be a strong tendency for him to discard it in the absence of supervision. The average worker would prefer taking an occasional risk rather than work under a continual handicap, particularly when he was being paid on a piece-work basis.

The human factors involved in industrial accidents presented a psychological problem which must be tackled along direct and indirect lines. The direct line of approach was to increase the employé's awareness of danger, particularly by the use of posters and slogans. Safety committees were formed to investigate accidents with a view to their prevention in the future, and every possible step was taken to induce the worker to inquire "Is it safe?" without, of course, over-emphasising the danger to such an extent as to induce nervousness. Special attention was also paid to the instruction of newcomers, both as to the dangers involved and to the course of action to be taken in emergency.

The indirect methods of approach aimed at improving the environment under which the employés worked. Attention was paid to lighting, to ensure that a proper intensity of illumination was secured at the working point, and to eliminate glare, flicker, and intensity contrasts. Arrangements were made to ensure that work was carried out at the optimum temperature, between 60 and 70 deg. F. Steps were also taken to improve the factory layout by the re-arrangement and proper marking out of transport tracks, by covering up moving parts likely to cause visual distraction, and by taking every other practical step towards eliminating any factors likely to distract the worker's attention from his job.

It was found that certain employés, because of their peculiar conditions, were more prone to accidents than the average. Selection tests of visual and motor fitness had been developed to indicate these types, and so allow of their transfer to less dangerous jobs. Special consideration was also given to the training of employés and the reduction of labour turnover on the basis that "the best man is the safe man," and that the experienced hand was less liable to accidents than the novice. Finally, accident clinics were established to diagnose and eliminate maladjustments, and special attention was paid to welfare work. All this, of course, involved considerable expenditure on the part of the management. The adoption of such methods, however, definitely led to a reduction in industrial accidents, and, in consequence, in industrial losses, and it was a policy that at the same time benefited both the employer and his workers.

Railway Electrification in Italy.

Some data concerning systems, sub-station equipment, and types of locomotives in use, together with a discussion of future policy from the economic standpoint.

By Commendatore G. BIANCHI.

(Extracts from a paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

RAILWAY electrification in Italy dates from 1897, when it was decided to carry out experiments with (1) accumulator traction, (2) the 650-volt d.c. third-rail system, and (3) the 3,000-volt, 15-cycle, 3-phase system. In 1905 the principal railways were taken over by the State, and between 1910 and 1916 some 230 miles of line were electrified on the 3-phase system at 16⅔ cycles. Owing to this system requiring special generating stations, further electrification has been carried out on the 3-phase system at the industrial frequency (45 cycles) and at 3,000 volts (direct current); the latter system has the advantages of simplicity of the overhead contact line and ease of speed regulation.

The principal difficulties with the 3-phase locomotive are due to the unsatisfactory operation of the trolleys and contact line at high speeds and to the fact that it is not possible to regulate the speed as closely as is necessary in practice. For instance, with motors having 6 and 8 poles, four speeds may be obtained, *viz.*, 23, 32, 46, and 64 m.p.h. Now it often happens that on some runs 64 m.p.h. is excessive, while 46 m.p.h. is too low. Intermediate speeds might be obtained by inserting starting resistances, but evidently this could be done for only a short period, as otherwise excessive heating would result.

The following requirements were recognised as essential when considering the choice of the system to be adopted for a large programme of electrification: (*a*) for level lines (in particular for the new line between Bologna and Florence and between Rome and Naples) a speed of 65 m.p.h. ought to be easily reached and be capable of slight regulation either up or down; (*b*) in order to employ in the best way the hydraulic power which is so plentiful in Italy, it is desirable, from both the technical and the economic points of view, that the power for traction should have as far as possible the same frequency as that for industrial purposes, and that there should be the possibility of using the same transmission lines as those for industrial supply.

The 3,000-volt d.c. system has been adopted on the Benevento-Foggia line, which has now been in operation for more than three years. The good results obtained, and the fact that both the desiderata (*a*) and (*b*) are satisfied, make it certain that this system will be adopted on other lines.

On the 1,013 miles now in operation last year's traffic was about 6,800 million tonne-miles, which represents about 20 per cent. of the total traffic on the 10,500 miles of railway track belonging to the State Railways. The train-miles operated in a year exceed 13 millions. The average hauled weight of these trains is 300 tonnes, while for the lines operated with steam locomotives it is 250 tonnes. The electrified lines, besides experiencing heavier traffic, have also the steepest gradients and greatest operating difficulties. The Genoa-Ronco line, for instance, has the maximum admissible gradient for a main line with heavy traffic (1 in 28) and increasing traffic, which may reach 3,000 cars per day, coming up from Genoa harbour. The Turin-Modane line crosses the Alps under Mont Cenis, and the Bolzano-Brennero line crosses one of the highest Alpine passes (4,300 ft. above sea-level), while the line now operating between Bologna and Florence crosses the Apennines, with gradients that reach 2.6 per cent. (1 in 38), and has more than 40 tunnels and very heavy traffic. The operating regularity of a line might be expected to be worse with electric than with steam locomotives, owing to the greater number of factors on which the operating regularity depends. Experience has, nevertheless, proved in Italy that in some instances the operating regularity on the electric lines is as good as that on the steam lines.

The direct-current 3,000-volt system has been recognised as the most suitable for high-speed traffic, and it will not remain restricted to the lines of southern Italy, as was originally intended. In fact, as it has recently been decided to electrify also the new Bologna-Florence line on this system, it may be necessary to carry out the electrification of the Florence-Rome and of the Milan-Bologna lines on the same system. When these works have been accomplished there will extend from Milan to Naples a line which, traversing the peninsula from north to south, will carry the greatest part of the longitudinal traffic of the Italian Railways. The 3-phase system will probably be limited to the Piedmont and Liguria section and, for some time to come, to some isolated lines, such as the Monza-Lecco and the Bolzano-Brennero. In the future it will become necessary to co-ordinate lines operated on the 3-phase and d.c. systems, and it will perhaps be necessary to convert some lines from 3-phase to d.c.

The whole of the coal consumed is imported; in 1929 about 12,500,000 tonnes,* of which about 2,700,000 tonnes was consumed in the operation of the 10,500 miles of the State railways. At present the cost per ton, placed on tender, is about £1 10s., but in 1929 about 10 thousand million kWh were produced by hydraulic-power plant, the average developed power of which now exceeds 2 million kW, and the electrification of the lines now in operation has resulted in a reduction of coal imports by more than 580,000 tonnes by the substitution of 347 million kWh of electrical energy per annum.

The cost of construction of the transmission lines, sub-station buildings, and machinery, contact lines, telephone installations necessary for the electric service, modifications of signalling and block installations, moving telegraph lines from near electric lines, modification of the station lighting installations, all work required in tunnels for installing the electric equipment, and the equipment of running sheds for electric locomotives, amounts to some £6,500 a mile for single-track lines, and to about £10,000 a mile for double-track lines.

With the normal density of traffic and frequency of trains it is estimated that an average of one electric locomotive is necessary for each 2 or 3 miles of double-track line. The cost of a 3,000-h.p. locomotive is from £9,000 to £12,000. The cost of electric power measured at the power station varies from ¼d. to ½d. per kWh, including interest, sinking fund, and maintenance cost of the high-voltage lines which connect the power stations to the railway lines. The maintenance and operating costs of contact lines and sub-stations vary from £180 to £320 per annum per mile, according to the importance of the line.

Power.—The consumption of energy at the generating stations is about 50 to 55 watt-hours per tonne-mile. The power consumed on the electrified lines from June, 1928, to June, 1929, amounted to 347 million kWh, of which only 80 million kWh was produced in power stations belonging to the State Railways, the remainder being bought from private undertakings. Actually the capacity of stations provided for railway purposes is about 180,000 kVA, whilst that of all the Italian stations is about 2 million kVA. It is estimated that the maximum power obtainable from hydraulic resources is about 32,000 million kWh per annum, when the total generating plant installed will reach 7 million kW. If we compare the total energy employed for the electrified lines (347 million kWh) with the total produced in Italy (10,000 million kWh) we see that barely 3½ per cent. of the total hydraulic power utilised is employed for traction purposes. As the traffic of the lines now electrified represents about 20 per cent. of the total traffic, it is evident that, even if the whole of the railway system were electrified and no more generating stations were constructed, the entire energy consumed for railway purposes would represent only a small percentage of the total produced.

With such an abundance of hydraulic energy and such scarcity of coal as there is in Italy, electrification of the railways is the natural course to adopt. Favourable conditions for electric traction, at least so far as the supply of power is concerned, exist in all those countries in which there is a system of power stations and transmission lines which assures the economical distribution of electric power throughout the country. In such cases railway electrification represents a transformation which does not differ from that experienced in other industries.

Regenerated Power.—On lines with heavy gradients the energy given back to the line by descending trains represents as much as 20 to 25 per cent. of the energy consumed in the ascent. The importance of regeneration, however, chiefly lies in the greater security of brake operation on heavy gradients.

There is still a difference of opinion as to the advantage of regeneration on d.c. systems, especially as either the mercury-arc rectifiers must be abandoned, or, if they are used, the regenerated energy must be dissipated in resistances. From the point of view of economy of energy on mountain lines regeneration is of primary importance.

Sub-stations.—On lines with steep gradients the average distance between successive 3-phase sub-stations is about nine

* One tonne = 2,204 lb.

miles; a spacing of 20 miles should not be exceeded, even on lines with little traffic, since the asynchronous motors of the locomotives are very sensitive to drop of pressure, the drawbar pull diminishing very rapidly (almost as the square of the voltage) as the voltage falls. Four, seven, or nine single-phase transformers are installed in every sub-station, one or two as reserves, of two types, *viz.*, 750 and 2,250 kVA.

The 3,000-volt d.c. sub-stations are installed at a distance of 30 miles apart to convert h.p. a.c. by means of motor-generators and mercury-arc rectifiers. In order to meet the eventuality of a sub-station breakdown which cannot be repaired in a short time, travelling sub-stations have been constructed, consisting of specially designed railway cars on each of which is installed a 3-phase, 2,250-kVA, o.f., s.c. transformer and automatic oil-switches. On the 3,000-volt d.c. systems the cars are also equipped with 2,000-kW mercury-arc rectifiers, and they have proved so advantageous from both the technical and the economic points of view, not only for emergency service, but also for continuous use, that their employment in place of ordinary sub-stations is now considered quite normal. Their cost is only about half that of an ordinary sub-station with a brick and cement building.

Locomotives.—On the 1,013 miles now electrically operated 791 electric locomotives are doing the same service as 1,200 steam locomotives with five, four, or three coupled axles of the most recent types. At the end of 1931 the total number of electric locomotives in operation will reach 888. The locomotives for mountain lines where the highest speed is only 32 m.p.h. cover from 30,000 to 50,000 miles per annum. Locomotives for passenger trains may run as many as 70,000 miles per annum. According to type, a thorough overhaul is carried out every 18 to 24 months of uninterrupted service, during which the locomotive is inspected every 7, 10, or 15 days; it is not kept in the shed for longer than a day. The number under, or awaiting, repair is about 20 per cent. of the total; on some lines it is as small as 10 to 12 per cent. The maintenance cost for an electric locomotive is low compared with the corresponding cost for a steam locomotive.

The principal reason for the adoption of the 3-phase system is the simplicity of the electric locomotive. Since 1920 the 2,400-h.p., 5-coupled-axles E 550 type, weighing only 60 tonnes, with two speeds of 16 and 32 m.p.h., has not been excelled for simplicity and lightness. Recently types of winding have been designed which allow three different numbers of poles to be obtained, while always employing every conductor of the winding, and without phase transformers. By this means three speeds out of four are obtained with the motors connected in parallel.

The only line actually in operation at 3,000 volts direct current is the Foggia-Benevento line, although the Benevento-Naples trunk line is now being electrified, and it has been decided to extend the direct-current system. Locomotive types can be reduced to three only, so that all the mechanical parts liable to deterioration are reduced to one or two standard types. As regards the electrical arrangements, standardisation has been most complete.

[The paper is very fully illustrated, contains maps of the lines already electrified and being converted, locations of transmission lines, power and sub-stations, and tables of costs, including the complete operating costs of the whole Italian railway system for both steam and electric traction.]

Discussion in London.

Mr. Roger T. Smith drew attention to the difference between the reasons which induced countries that had plenty of coal, like ours, and those that had no coal, but plenty of water power, to spend capital on railway electrification. The carriage of coal represented a substantial part of the revenue of the British railways; unless real overall economy was obtainable, or for some other reason, such as applied to suburban traction, the collieries would not expect the railways (their best cusomers) to reduce their coal bills by half. British main-line conversion would be undertaken only as the result of a material reduction of the cost of electricity. The author's water-power cost was very little less than the cost of energy derived from coal-fired stations in Britain. All British electric traction was suburban, whereas all Italian was main line; the total single-track mileage was a little greater in Italy, but traffic density was only half that in Britain, where 2.25 times as much (tonne-km) was carried. The author's figure of 67 electric locomotives doing the work of 100 steam engines should approach 50 as time elapsed. Nowhere in the paper was it explained that the 3,000-V, d.c. locomotives were fitted with 1,500-V motors. The low Italian axle loading had avoided the rebuilding of many bridges, &c., and was a real achievement; did it still obtain?

Mr. Douglas Vickers remarked that he had had occasion to travel frequently on the electric railways in Italy and he knew what good service they were giving. He had taken Lt.-Col. Cortz Leigh to Italy to enable him to see what was being done there, and he was sure that few other countries would have been so ready to show foreigners so much.

Mr. Forbes Jackson pointed out with regard to energy consumption that curves and grades were much less severe in Britain; therefore there should be less difference between the actual and virtual ton-mileages, and he would expect something less than the author's 40 watt-hours. A number of builders of side-rod locomotives was now turning to the individual drive, and *vice versa*. A d.c. passenger locomotive could be made to reach 75-80 m.p.h. quite well on an average track. A coupled locomotive would be less likely to slip its wheels; for braking requirements more weight was needed than for haulage simply. The fact that a greater range of speed was obtainable with a d.c. locomotive was of importance for main-line work, but it was not given the attention it should have.

Major T. Rich said it was not generally realised how many fundamental questions had been worked out by the Italians, who should be congratulated on what they had been able to do in the face of all manner of difficulties. The way in which heavy traffic was maintained up very steep gradients was remarkable; the port of Genoa owed its prosperity entirely to that fact, which would have been quite impossible under normal steam conditions. Overhead bow current-collection was very efficient, being almost sparkless at night.

Mr. H. C. Cooper did not think the magnitude of the schemes carried out in Italy were always correctly appreciated, and he exhibited a lantern slide which showed the Italian electric lines superimposed on a map of England. Twenty per cent. of locomotives under repair seemed rather high, and was perhaps due to the older types still in use. The author's interest and wages figures were not clear.

Mr. A. G. Hopking explained that d.c. overhead construction was simple; 1,500-V d.c. had been recommended for use in Britain, and it was good to have the author's confirmation. It was disappointing that his trailing cost was not much lower than that of steam traction, and his interest seemed somewhat high.

Mr. J. R. W. Grainger pointed out that the costs of fuel and electricity were about equal to those in England; the high cost of steam traction in Italy was due to the difference between the costs of coal here and there. Steam engines' fires had to be banked while they were idle, whereas electric locomotives used energy only when working; therefore electric shunting costs should be lower. The author's table of costs required amplification.

Lieut.-Col. F. A. Cortez Leigh congratulated the author upon the title of Commendatore recently conferred upon him by the King of Italy, and on his valuable paper, which contained actual figures and not estimates. He very much appreciated the facilities placed at his disposal during his visit to Italy. The satisfactory operation and efficiency of the d.c. system was most encouraging, and the degree of standardisation achieved must be very helpful from the maintenance point of view. Did bonding the track rail by welding tend to soften the rail?

Sir H. Hartley asked if the author had any experience of mercury-vapour rectifier sub-stations at lower voltages, and whether his mobile sub-stations necessitated the provision of special sidings.

Dr. A. H. Railing inquired whether the author could, after several years' operation, attribute any definite superiority to the mercury-vapour rectifier over the rotary convertor. How did the maintenance cost of d.c. traction compare with that of other systems?

Mr. J. M. Kennedy said the paper was encouraging; the Central Electricity Board was already engaged on the subject, and it was hoped to obtain energy at costs as favourable as the author's. Considering the evolution of the 3-phase system it was interesting to note that the author's views were changing (like theirs) in favour of d.c. In view of the greater congestion sub-stations in Britain would have to be located from 12 to 15 miles apart, but it was not always appreciated that the cost of sub-stations was small compared with that of locomotives; travelling sub-stations should reduce the cost greatly on some lines. The author's wages figures were mysterious.

Commendatore G. Bianchi, in reply, explained that steam and electric traction costs could not be easily compared, as the conditions were so different in Italy. Shunting was done with the same locomotives as were used on main lines and so costs could not be compared in that case either; it was not convenient to shunt with 3-phase locomotives. The rectifiers had worked very well and they intended to use them exclusively in preference to rotary convertors.

Mr. C. C. Paterson, president, expressed the Institution's appreciation of the paper and the author's presence, for it required some courage to come to a foreign land and speak a foreign language on such an occasion.

Generation of Electricity.

The official returns rendered to the Electricity Commissioners show that 963 million kWh of electricity was generated by authorised undertakers in Great Britain during the month of October, 1930, as compared with 949 million kWh for the corresponding month of 1929, or an increase of about 1.5 per cent. During the ten months of 1930 up to the end of October, the total amount of electricity generated by authorised undertakers was 8,684 million kWh, as compared with 8,240 million kWh for the corresponding period of 1929, representing an increase of about 5.4 per cent.

Electric Welding.

Some notes on the process, with particular reference to the automatic flash-welding machine.

By C. A. Hadley.*

(*Extracts from a paper read before the* ASSOCIATED FOREMEN SMITHS OF SCOTLAND *at Glasgow.*)

FOR some classes of work, smith's forge welding will probably never be altogether replaced by welding machines. There are, however, some classes of welds that the smith would rather not be asked to make. The trend of progress and competition call for the production of high class products at a very low price, which necessitate the use of pressings, stampings, and rolled sections that are afterwards welded together to form the required unit. Those parts are made of good quality medium-carbon steels, often of high tensile strength, wrought irons of the quality which welds readily in the forge not being suitable for such products, nor do they make strong reliable welds when the electric resistance-welding machine is employed, on account of the slag which segregates and tends to cause the metal to split.

Forge welding involves the employment of highly skilled labour under uncomfortable and exacting conditions; perhaps its chief advantage is that the joint is afterwards well hammered, tending to correct the previous ill-treatment the metal has been subjected to. Arc welding also requires highly trained and skilled operators, but the process is so adaptable that its use is ever increasing; so much so that it is becoming a menace to the foundry on account of the number of machines of large dimensions which are now being built up from steel plates and sections by arc welding, thus replacing the cumbersome and expensive method of making elaborate patterns and casting from them. The process is not likely to be a cause of unemployment, for many industrial centres are training unemployed men to do such work. Although reasonably cheap, it is, however, a piecemeal process, so that for reproduction work it is comparatively slow in operation. The electric resistance method of welding is scientifically perfect in theory, simple to operate in practice, and the result leaves little to be desired in the quality of the weld, cost of production, or ease of control. The relative amounts of energy required to weld steel and copper are approximately in the proportion of one to five. Since the contact resistance alters as the metal heats, is also dependent upon the applied pressure, and varies during the welding process, it is difficult to conceive a practical formula which could be usefully applied to all working conditions. It is, however, useful to assume that a butt weld of steel requires from 0.3 kWh per sq. in. sectional area (for thin material) to 0.5 kWh (for thick material), and copper 1.5 kWh. Generally, the softer the metal the easier it is to weld. The higher carbon steels are usually more difficult to weld by ordinary methods, for the distribution of the mixture is profoundly influenced by heat treatment; thus the less free the iron in the steel the more exacting will be the conditions required to produce a weld. In fact, it is necessary actually to melt together the higher-carbon tool steels and alloy steels of the self-hardening varieties in order that they may be welded.

Now, if we can locate and concentrate the heat at the junction only, and rapidly graduate the temperature beyond the junction, it is possible to apply great pressure directly the required welding temperature is reached and squeeze out any excessively hot metal from the joint, at the same time forging the metal at the correct temperature. It is of little consequence if the steel at the junction be molten, for it will be "spewed" out of the joint by the pressure applied. If that operation can be performed in an atmosphere of vaporised steel, air will be excluded and no harmful gases will reach the hot metal; we thus work under the most favourable conditions. All that can be accomplished with the electric butt welding machine and with the modern automatic flash welder we can predetermine the three essential factors: time, temperature, and pressure. Electric welding machines are made in various forms, all of which effect a considerable saving in the cost of production. Of them all, the resistance butt welder is of most value to the engineer. Its range is from small-diameter wires to sections up to 20 sq. in. in sectional area; welds are produced at small cost and often with great rapidity, with nearly all metals and alloys in general use. Although a welding machine can be quickly adapted to weld articles of widely different shapes and sectional areas, it shows to its best advantage when large numbers of one type of weld are required, in which case jigs are used to hold the parts automatically in true alignment. When the parts to be welded are moved together into contact, heavy pressure is applied to the joint in order that the steel may be refined in structure after being subjected to a welding temperature, but the metal heats back from the weld by conduction, so that when the forging pressure is applied a bulbous upset is produced, which is often afterwards swaged down, or machined off. Thus difficulties arise when attempting to weld sections which are thin for their sectional area, first, owing to the metal heating back and thus preventing sufficient forging pressure being applied without distortion, and, secondly, on account of the contact resistance, and therefore current density, varying at different parts of the contacting surface and causing one part to overheat before another part is heated sufficiently to weld. This trouble does not occur when welding compact sections, for the temperature over the face is evened by the rapid absorption of heat by the mass of metal behind the heated portion. The difficulty has been overcome by the so-called "Flash Welder," which is similar in construction to the simple butt welder, but its secondary voltage is raised to such a value as will produce a current density at the joint so intense that when the ends are brought into contact the metal will be instantly burned away, accompanied by a shower of sparks; in fact, an incipient arc is produced. Since the arc is not stable, the ends must be approached together at the exact speed that they are consumed. The electrical resistance of the joint is then much greater than that of the metal under weld and, since the quantity of heat produced is the product of the square of the current and the resistance, the heat is localised at the joint. Less metal is then being heated than before; therefore, less time and energy are required to make the weld, and the metal will heat back for only a fraction of an inch from the weld. The steepness of the heat gradient must, however, be correctly proportioned and in order to produce consistently perfect welds under these conditions it is necessary to remove the human factor and use a machine which is not only automatic in action, but can also be readily adjusted to produce the exact cycle of operations for the material being welded. In the latest type an electric motor is embodied in the machine to produce the power necessary for approaching the parts together. The energy required for the forging period is stored up in a flywheel, so that quite a small motor only is required to be used. The importance of properly forging the weld after raising the temperature to the welding heat cannot be too greatly stressed. For most commercial purposes it is unnecessary to normalise, but the weld should be treated if it is necessary for the material to be stressed very heavily in use.

It is notable that one factory alone in Birmingham makes over 40,000 of these welds weekly. The new type of Ford car has some 1,300 electric welds in its structure, the majority of the electric resistance type.

* Director, British Electric Welding Machines, Ltd., Dudley, Worcestershire.

Luminous Electric Tubes.

Some observations and comment on gaseous illumination, which is probably destined to supplant eventually the existing metal-filament lamp.

(*Extracts from an address before the* JUNIOR INSTITUTION OF ENGINEERS, *London.*)

MR. H. MARRYAT, M.I.E.E., M.I.Mech.E., in the course of a recent address to the above-named Institution, explained that illumination by means of luminous tubes, generally termed neon lighting, comprised also the use of other gases, such as argon, helium, krypton, mercury-vapour, and carbon-dioxide. Most people thought of neon lighting in terms of a new advertising abomination, but it had unquestionably come to stay, and he, personally, saw in its future a form of lamp which would one day supplant the existing filament lamp.

Although the tubes appeared to be very simple, consisting of nothing more than the Geissler tube commercialised, yet colossal difficulties had had to be overcome before a marketable article fit for everyday use under varying conditions of exposure and climate could be produced. Even to-day many technical difficulties faced manufacturers, but some of the finest research laboratories in the world were engaged on the subject. The lecturer outlined the history of vacuum research, and recounted in some detail the romantic story of the first separation of argon, helium, krypton, and neon from the nitrogen in the atmosphere in 1894-98 by Lord Rayleigh and Sir William Ramsey. He made the point that the discovery was all-British, but explained that its commercial development was French. M. Georges Claude had spent many years in determining the conditions under which a neon tube could be made of commercial reliability and efficiency at a reasonable cost.

A large number of specimen tubes was exhibited illustrating the natures of the gases employed to obtain various colours. The colours emitted by some gases depended upon the pressure employed; for instance, helium would give a light varying from white to straw, biscuit, pink, and even to a fine scarlet, if the gas pressure and e.m.f. were suitably adjusted.

A hundred or so companies in various parts of the world were now exploiting the Claude patents; all otherwise independent units, they were connected in respect of an agreement to interchange technical information and research results, so that France, Germany, America, and Britain were all contributing to advance the science of tubular lighting with a common interest. The method of manufacture as followed in the Paris factory was described, the various processes of straightening and washing the tubes, welding, bending, fitting the electrodes, pumping, occluding impurities from the tubes and electrodes, testing, first filling, second filling, and ageing, the main object being to introduce a minute quantity of absolutely pure gas into an absolutely clean tube from which every trace of other gases, even those imprisoned in the pores of the glass itself, had been removed. It all sounded

very simple; in practice it presented difficulties which were only overcome by introducing the methods of the precise scientific worker into the factory.

Only certain special glasses were suitable for quick and satisfactory working by bench blowers bending and welding tubes up to 30 mm. diameter; no cracks or pin-holes should develop after annealing; no undue strains should be set up in the bended or welded parts, which would cause the glass to "fly" from climatic temperature changes, frost to sunshine, or reasonable mechanical strains, such as wind pressure. It must also be capable of sealing in the electrode leads, and should be of such a nature as readily to occlude any air or gases contained in its pores. In France a hard "Pyrex" glass was used, but in England the Neon Company had found a special glass produced by associated glass works. To discover hidden strains set up in the glass in the process of bending, the tubes, when finished and before pumping, were examined in an instrument employing polarised light, which revealed any strain in the glass by producing a vividly coloured streak at the place. When this happened, the tube had to go back to be reannealed, or, as often happened, to be remade.

The difficulty of obtaining some of the rare gases in a sufficient state of purity to give the best results was emphasised. In the case of helium obtained from the atmosphere, it was a long and tedious process to remove the last traces of neon; in fact, it could not be done completely, so the lecturer had lately been obtaining a supply of pure helium from othre sources, in which no neon mixture occurred, and it had proved very successful.

The voltages employed for the earlier installations in London were in the range of 16,000 to 32,000 volts, and they were all working satisfactorily after eight years. The general voltage employed in London had been 8,000 V, but recently there had been a tendency to reduce it to 2,000 V and even to 1,000 V; in certain cases tubes had been produced to work directly upon a 200-volt circuit. Alternating current was always employed, and where direct current only was available it was necessary to install a rotary convertor.

With regard to the life of the tubes, 2,000 hours might be considered a reasonable average, but for special purposes tubes could be made to have 9,000 hours' average life, and some of them had actually burnt for 25,000 hours continuously without showing any sign of failure. When gas failure occurred it was not necessary to remake the tube, but only to refill it.

Perhaps the most important use to which the tubes were applied at present was for lighting aerodromes and air routes. The red light was particularly adapted for the penetration of a thick atmosphere. Although, no doubt, red light obtained by screening white light was equally effective, there was an immense difference between the efficiencies of red light obtained in those two ways. A large number of aerodromes was now equipped with neon beacons, those at Croydon (London, England) and at Tempelhof (Berlin, Germany) being illustrated on the screen and described; the light from the Croydon beacon could be seen by airmen when flying over France. The lecturer also illustrated and described a large number of other applications of neon light to night flying on air routes and for landing at aerodromes; also methods of indicating wind pressure and direction at ground level to enable a pilot to alight against the wind and at the correct speed. The important questions of glare and dazzle were referred to, and the advantages of neon as against any point light source were emphasised in this respect.

The address concluded with a description of the remarkable progress of neon light for advertising and display purposes on the European Continent and in America, and the prediction of a similar overrunning of this country with neon display lighting. Some of the more extravagant installations were illustrated; an advertisement in California, U.S.A., comprised 56-ft. double outline letters fixed upon 80-ft. poles.

Mr. Marryat foresaw, perhaps not in the near future, but certainly in the end, white tubular light. Already such white-light lamps were made, and he had actually handled a number turned out in the laboratory. In outward appearance they resembled a 100-watt lamp. It would be a long time before they would be marketable articles, but the fact that inherently the discharge lamp had a higher efficiency than the filament lamp meant that the principle would be pursued relentlessly until all barriers to its production had been overcome.

Chromium Plating.

Proposed Home Office Regulations; Some Practical Difficulties in Electro-deposition.

(*Extracts from the proceedings of the* ELECTROPLATERS AND DEPOSITORS' TECHNICAL SOCIETY, *London.*)

A SPECIAL meeting of the above-named Society was held to give members an opportunity of exchanging their views on draft chromium-plating regulations.

Dr. R. S. Hutton, president, pointed out that it was the duty of the Society to provide facilities for the fullest interchange of opinion on the proposed regulations, but it must be understood that the Society had no official views on what was not, primarily, a technical matter; the opinions expressed would not commit the Society in any way.

Home Office Regulations.

Dr. S. G. Overton, one of H.M. medical inspectors of factories, explained that she hoped to hear the views of the trade on the subject, but that she spoke in an unofficial capacity. Whilst the control of chromium plating by regulation was new, somewhat similar dangers arose many years ago in industries in which bichromates were used, such as chemical works, tanning, dyeing, &c., and regulations made by the Home Office had markedly reduced the risk to the health of workers in those industries. A very careful investigation had been made of the necessary protection of workers in chromium-plating plant, and the draft regulations resulted from that investigation. Chromium was not generally poisonous to the system in the sense that lead, mercury, and arsenic were, but in certain forms it was dangerous because of its irritant action on the mucous membrane and the skin. Chromium plating had been declared a dangerous trade; therefore the Secretary of State had power to make compulsory regulations for its control under Section 79 of the Factory and Workshop Act, 1901, and draft regulations had already been published.

Dr. R. S. Hutton pointed out the importance of the time factor, and emphasised the necessity of taking immediate steps to remove chromic acid from the skin, and to treat chrome ulcers.

Mr. E. A. Ollard felt that the draft regulations were necessary and, for the most part, reasonable, but that the wording was somewhat indefinite; thus, the local factory inspector would be the judge of whether the arrangements were suitable or otherwise. He trusted that the interpretation of the regulations would not be harsh, especially on the smaller platers, who were often not in a position to make expensive alterations to their plant, and would be uniform throughout the country.

Mr. S. E. Weill said he was convinced, from his wide experience of over 100 chromium-plating installations which had been under his observation during the last three years, that a fortnightly medical examination of workers was unnecessary. The appearance of yellow spots upon a sheet of tissue paper held above the bath was a sign of insufficient exhaust, and he had found that test to be satisfactory. There was no danger from the chromium fumes, other than liquid spray.

Several members and visitors asked for detailed information

Dr. S. G. Overton, in her reply to the discussion, said that, whilst chromic acid did not cause ulceration of the unbroken skin, small abrasions often rapidly developed into chrome sores if in contact with certain chromium compounds; hence the insistence on the wearing of protective clothing and the periodical medical examination. Precise standards of what was "efficient" or "suitable" were not defined in the draft regulations, for it was considered more satisfactory that local factory inspectors should judge the adequacy of the precautions taken; they would not act unreasonably. The fact that no casualties had occurred could not be taken as evidence of the efficiency of the precautions. A paper had been published in America (U.S. Public Health Reports, Vol. 43, No. 26, September 7th, 1928, "Health Hazards in Chromium Plating," J. J. Bloomfield and W. Blum) which gave standards with which the Home Office was, in general, in agreement. Polishers would not, apart from washing accommodation, be included in the regulations unless they actually came into contact with liquid containing chromic acid and salts of chromium. Exemption might be granted when it was satisfactorily proved that no danger existed. Fair persons were more susceptible, but there was no evidence of the relative greater susceptibility of women and young persons. There appeared to be danger from fumes as well as from the spray produced by electrolysis.

Mr. G. L. Hack, of Rudge Whitworth, Ltd., in a written communication, stated that the Coventry and District Engineering Employers' Association was in general agreement with the proposed precautions, but felt that some amendments were desirable.

Practical Difficulties.

Mr. J. W. Cuthbertson, M.Sc., in a paper he read before the Society in October, expressed the opinion that, although the electrodeposition of chromium had passed far beyond the experimental stage, the process was still, in some respects, unsatisfactory, being beset with several practical difficulties. Success depended in no small measure upon the skill and experience of the plater. He summarised the conditions necessary for obtaining satisfactory bright chromium deposits as follows:—

1. The solution giving the best results was made up of chromic acid and a sulphate, and should be carefully controlled; the current density and vat temperature should also be kept within fixed limits.
2. Careful preparation of work was important, paying special attention to the production of a good, tight, nickel deposit under the chromium.
3. Lead was the only material that could be considered for anodes; the shape and arrangement of the anodes should be influenced largely by the type of work being plated.
4. No attempt should be made to plate large and small work at the same time in one vat; small articles, such as screws, must all be wired separately, not put into a basket; a good method of handling small screws was to insert them into a piece of fairly heavy-gauge copper wire gauze.
5. Copper articles were best plated without a nickel undercoating; nickel must be used, however, if the brilliant blue lustre associated with chromium was insisted upon.
6. Iron should not be allowed to increase in the vat above a very low concentration.
7. Success depended very largely on the individual; a properly-developed technique, plus careful attention by the plater to the details of the process, would go far towards producing a sound finish.

The author thanked the Manchester Chrome Plating Co., Ltd., for advice, assistance, and the use of its plant for experimental purposes.

Chromium Bibliography.

The Société Français des Electriciens, of Paris, prints in the October issue of its *Bulletin* a bibliography of the world's works, books, papers, &c., on the subject of chromium plating, compiled by M. Altmayer, in chronological order and under authors' names; it contains the titles of no fewer than 87 works on the subject by American, French, German, Swiss, and British writers.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

An Improved Water-purity Meter.

The portable "Dionic" water tester has for a long time provided a valuable check on the operation of boilers and condensers, but it has been felt that an instrument giving a continuous record would be far more useful than the portable type to power station engineers. The "Dionic" water-purity meter recently introduced by Messrs. EVERSHED & VIGNOLES, LTD., Acton Lane Works, Chiswick, W.4, is the answer to that. It employs precisely the same principle as the portable instrument; that is, it measures the conductivity of water or other dilute solutions between two electrodes. Instead, however, of there being a "Megger" or "Meg" type of instrument, which the testing engineer requires to operate to take the reading, the instrument is fed from the mains or a battery, giving a continuous reading to the indicator or recorder. This result was not obtained without some considerable research, however, on account of the necessity of providing automatic compensation for variation in the temperature of the water or solution under test. The importance of this compensation may be appreciated from the fact that the temperature coefficient for boiler water is normally 2 per cent. per deg. C. The automatic compensation has been neatly provided in the form of a plunger, which moves up and down in the tube providing the measured path, thus altering the average cross section of the column of water under test. This plunger is operated by a bi-metallic strip immersed in the solution under test, and is therefore always held at the same temperature. The device is very simple in operation, requires no adjustment, and is robust. The construction is sturdy, and the glass tube will withstand a water pressure of 40 lb. per sq. in., while the instrument is not adversely affected, either mechanically or electrically, by a glut of impure water. The meter is supplied either as a self-contained instrument in the form illustrated, fig. 1, or with water tube and indicators or recorders for separate mounting. A special indicator is sup-

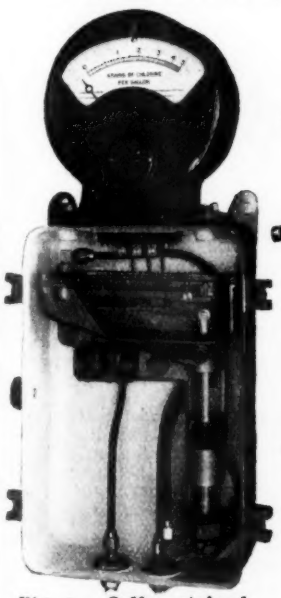


Fig. 1.—Self-contained "Dionic" Water-purity Meter.

Figs. 2 and 3.—Two- and Three-contact "Saxonia" Switch Tubes.

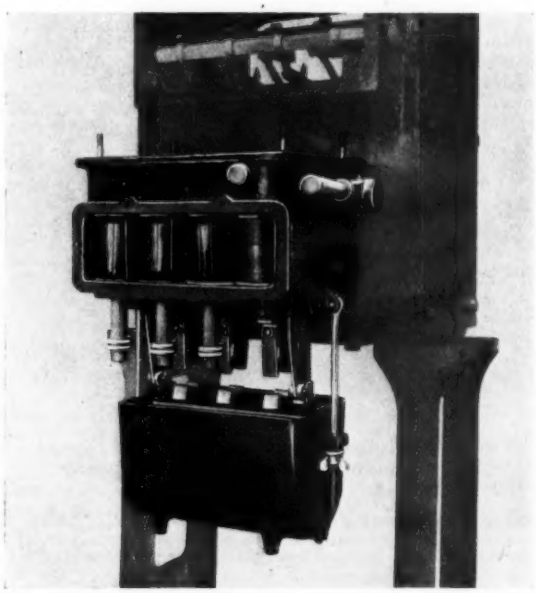


Fig. 4.—"J. & P." Ironclad Oil Circuit Breaker.

plied when required with an alarm device, which can be set to sound a horn, or to switch on a warning lamp, when the conductivity of the solution under test exceeds a pre-determined point.

Mercury Switch Tubes.

The accompanying illustrations, figs. 2 and 3, are selections from the wide range of mercury switch tubes produced by the SAXONIA ELECTRICAL CO., LTD., Roan Works, Greenwich, S.E.10, after careful research. These "Saxonia" tubes should prove of particular interest to manufacturers of electric heating, alarm and signal, radio and remote-control equipment, refrigeration plant, time and float controls, and lift, traffic, sign and safety devices. The two-contact switch, fig. 2, ten amperes, is recommended for thermostatic control, and for remote-control switches for wireless sets, pattern No. 4, two amperes, is recommended. The inert gas, with which these tubes are filled, prevents oxidation and reduces the spark to practically nil. The Saxonia Company can supply time-lag switches with from ten to a hundred-and-twenty seconds lag, and upon application, List No. 11029, illustrating quite a dozen different types, can be obtained. The switch tubes are made as small as two amperes and as large as fifty amperes, for 500 volts. The two-contact model, fig. 2, is 80 mm. long and 10-12 mm. in diameter, and is available in capacities of 2, 4, 6, 8, 10, 12 and 15 A. The three-contact model, fig. 3, measures 50 mm. by 10 mm., and is available in capacities of 2, 4, 6, 8, and 10 A.

Switchgear-range Extension.

Messrs. JOHNSON & PHILLIPS, LTD., Charlton, S.E.7, advise us they have added to their range of ironclad oil circuit breakers, fig. 4, two additional sizes of switches, thereby extending the range of this class of gear from 75 to 1,000 A capacity. The two new designs are the smallest and the largest. Both these switches are designed to be generally in keeping with the remainder of the apparatus in the range, and they can be supplied either as individual units or to form part of a multi-panel switchboard. Any size of switch within the limits can be fitted to a common bus-bar system, so that it is not necessary to have the various units forming the switchboard larger than is necessitated by the requirements of the individual circuit. The robustness of design of the range of gear is maintained in the new units, as is also the useful feature of the internal connections ending in the cable box, so that it is not necessary for the man on site to open up the switchgear chambers and make awkward connections therein with his cable ends. The equipment is also made in the draw-out pattern for circuits up to 700 A. The complete range is for use on pressures up to 660 volts, but similar designs are available for use on 3,300 volts up to 150 A.

A Vibration Recorder.

The following is a brief description of the Trub, Tauber miniature portable universal 3-component vibration meter, which is handled in this country by the ANGLO-SWISS ELECTRICAL CO., LTD., 15, Victoria Street, S.W.1. This instrument is primarily intended to give a chart record of the vibration

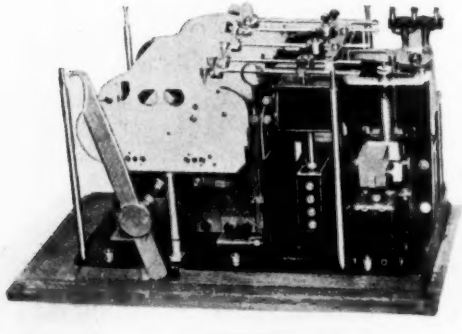


Fig. 5.—Trub, Tauber Vibration Recorder.

and shocks occurring on locomotives and rolling stock, and it can be adjusted to record to any desired scale from full size to twice full size. It comprises three independent miniature seismographs, each of which records one of the three components. When the instrument is suitably placed, one horizontal component records the vibration in a longitudinal direction, *i.e.*, along the longitudinal axis of the train or vehicle, and the other records vibrations at right angles to the longitudinal axis. From the records of the vibrations in the three places at right angles it is possible to determine the movement as a whole of the spot where the vibration meter is mounted. The outstanding feature of the apparatus is the powerful air and oil damping of the components, combined with very low friction. By virtue of the special oil damping, it is possible, it is claimed, to obtain a faithful record of the severe shocks which occur in traction work without any risk of resonance. At the same time, owing to the small amount of friction present, the instrument will record accurately vibrations of relatively small amplitude, and each of the pen arms has a well-defined zero position. All five pens record in ink on a common chart, the effective width of which is 150 mm. The chart is driven by a hand-wound clock. The complete instrument is contained in a portable oak case fitted with a leather carrying strap and measuring 440 by 250 by 260 mm. Fig. 5 shows the recorder with the cover removed.

A New Lamplocking Holder.

An interesting new form of lamplock has just been introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. Known as the "Kinloc" dual-purpose lampholder, it consists of a b.c. lampholder in which is incorporated a special device for locking the lamp, if desired. Nothing extra is required, apart from a special tool in the hands of an authorised person. Various types are made, particulars of which will be given on application to the company. They can be supplied either with a cordgrip or in the screw-on type in the whole range of threads usually employed. Two forms of key are available, one for use where shades or reflectors are not used, and the other for passing between the lamp and the shade even if the latter is of the narrow bell shape.

Cable-jointing Conductor Sleeves.

Referring to the notice under the above heading in this section of our last issue, the sleeves produced by Messrs. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., are made of tinned wrought copper, and not of wrought-iron, as stated.

Illumination-strip Lampholders.

We learn that two new models of the "Beeantee" illumination-strip lampholder (see ELECTRICAL REVIEW, May 9th, 1930, p. 889) have been introduced by "BEEANTEE" ILLUMINATIONS, LTD., 70, Banner Street, Bunhill Row, E.C.1. One provides for the use of Edison screw-cap lampholders, and the other is equipped with a shade-carrier ring. Improvements introduced on some models of these lampholders are a weatherproof shield at the bottom of the holder, and a flexible watertight gasket at the entrance of the lamp. It will be recalled that the holder is designed essentially for use with flat twin tough-rubber sheathed cable, contact with the conductors being made by sharp projections from the lampholder plungers which pierce the sheath at appropriate points.

Legal.

Claim for Service Connection.

AT the Mold County Court last week, the Mold Urban Council claimed £16 18s. 6d. from Mr. J. B. Price, an auctioneer, as the cost incurred by the Council in laying an electrical service to the defendant's house.

According to the *Liverpool Post and Mercury*, Mr. R. S. Kelly, clerk to the Council, said that the cable passing Mr. Price's house was an overhead one, but as he wanted an underground service, and as, at his agent's request, this was put in, Mr. Price must pay the difference between the underground and overhead service.

Mr. REGINALD GREGORY, the Council's electrical engineer, said that on this particular cable there were only three consumers, and the line was erected because of its cheapness. An underground service was four times dearer than an overhead one, and if everyone in Mold wanted an underground service from an overhead cable the concern would soon go down.

The Council's Order authorising it to supply electricity was discussed. The Judge asked who had drawn up the contract as between the Council and customer, and on being told that an eminent engineer had done it, the Judge remarked, "They would not go to a lawyer; the result is no one knows exactly what two of the clauses mean. Lawyers are despised, but when folk are in trouble they are the first people they run to."

The JUDGE stated that it appeared to be a difficult legal case, so he would adjourn it to the next Court, when he would hear the defence and legal arguments.

Theft of Electricity.

THE Wallasey magistrates on November 21st ordered Harry Holmes, bootmaker, Hoylake Road, to pay 15s. for illicitly taking a supply of electricity. Defendant's meter was disconnected on September 29th, the fuses were withdrawn and seals affixed. Subsequently defendant applied for a shilling slot meter. When an inspector visited the premises he found that rubber flex had been affixed to the mains and that a lamp was burning in the shop. The magistrates took into consideration the fact that the defendant invited the Corporation official to the premises and had not hidden what he had done.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Overheating of a Flywheel Motor.

In answer to "R.Y.'s" letter on above subject in your issue of November 7th, it is a pity that he did not give the nature of the load or state what the motor was driving.

If the load is a very variable one, as, for instance, a rolling mill load, the peaks of which are frequent and vary from, say, 1/2 normal load to 100 per cent. overload on the motor when the resistance in the rotor circuit is equivalent to 7½ per cent. slip, then if the slip is increased to 10 or 12½ per cent. the motor load would be evened out somewhat, *i.e.*, it would vary from, say, 3/4 normal load to 75 per cent. overload on the motor, or, in other words, the peaks should be lessened. Now since the heating of any motor varies as the square of the current, it is obvious that with greater slip the heating of the motor would be less for the same work performed, *i.e.*, in the case of a rolling mill drive for the same tonnage rolled per hour.

In other words, if there were no flywheel installed on the drive and the motor had to do the whole of the load, then a larger motor would be required than if the work was spread uniformly over the same time, in which case a motor equal to the average load is all that would be required.

The heating effect, however, with only a difference of 2½ or 5 per cent. in the value of the slip, would hardly be noticeable, probably only a difference in temperature rise of one or two degrees Centigrade. It is true however that, with the greater slip, the average speed is less and therefore the ventilation will not be as good as with the less slip, but here again the percentage difference will be small and will not be as great as the heating effect due to the larger peaks carried by the smaller slip.

With regard to the question of power factor, this depends on the design of the motor, so we will take two examples in design.

(*a*) Motor with a pull out torque just sufficient to give a running torque equal to 100 per cent. overload of the motor.

(*b*) Motor with a pull out torque sufficient to give a running torque of 2½ times the normal torque.

The power factor curves can be plotted from the following approximate figures:—

	½	¾	Full	1¼	1½	1¾	Full load 2
(*a*)	.6	.72	.77	.8	.81	.79	.71
(*b*)	.54	.66	.73	.77	.815	.81	.805

Assuming now the conditions set out in the first paragraph, it will be seen that with 7½ per cent. slip and a motor as (*a*) the power factor varies over the whole range, whereas with a motor slip of 10 or 12½ per cent. the power factor varies over a smaller range, which range is over the higher portion and therefore must have a higher average power factor than the motor with 7½ per cent. slip. It will be seen also that the same occurs with a motor with power factors as (*b*).

With motor (*a*), however, the slip will not vary as a straight line beyond, say, about 15 per cent. slip, so that if peaks of 100 per cent. are to be met the speed will drop considerably and so may result in increased heating owing to poorer ventilation due to the average speed being lower. With motor (*b*) the slip will vary practically as a straight line with 10 per cent. slip right up to 20 per cent., so that the average speed will be higher and therefore result in less heating on the motor.

There is another point which may now be causing overheating. The first pull over of the motor may have been caused by the rotor not being set centrally, the pull over causing rubbing between the stator and rotor. This rubbing may have damaged the punchings of either stator or rotor or both, burring over the edges of the punchings. If this has happened then the affected parts may cause local heating, which can only be remedied by rebuilding that portion of the machine, or by regrinding the stator or rotor. If this be not the case then it appears probable that the overheating is caused by one of two things:—(1) the rating of the motor is small for the work to be performed; or (2) the motor design is too highly rated for the specified rating of the machine.

Condition (1) can easily be checked by ammeter and voltmeter readings compared with kWh consumption figures; as a rough check the heating effect will hardly ever exceed 1.1 times the average load taken from the kWh consumption figure over a given time.

If (1) is found to be correct as regards the load when compared with the specified rating, then it would appear that condition (2) is the cause of the fault.

There may, however, be other causes contributory to the overheating of the motor. There may be an excessive voltage drop on the supply line, due to the peak loads, or the line may be overloaded, or again the voltage regulation at the generating station may be at fault, causing unnecessarily large currents to be taken by the motor for a given load, but this can be checked by observing the voltage drop at the generating station when the peaks come on.

With regard to the trouble of flashing over at the slip rings, this would occur only on starting up, as then the rotor voltage is the maximum. Variation of the solution in the starter will not overcome this, as this will only increase or decrease the current taken when starting. Since the slip rings have been thoroughly cleaned and the insulation is good, no conducting dust should be present between the rings, and it therefore appears that the slip rings are placed too close together to stand the 680 rotor voltage, although this voltage seems low for such a motor.

Whatever the cause of overheating it seems incredible that the yoke should distort sufficiently to cause rubbing, but if such is the case then the motor yoke is not mechanically strong enough; this is a very bad point in design as is also the point of the closely-spaced collector rings. The question of the motor design for peak load should be familiar, if the designer knew the nature of the load to be met, and it should have been allowed for accordingly.

W.E.T.

November 18th, 1930.

Prospects Overseas for Young Engineers.

With reference to the letter by "Eee Bee" in your issue of September 5th, as I understand that the information obtainable from the various Empire headquarters in London is general rather than special, I am taking this opportunity of replying to your correspondent, and to any other engineers who are contemplating setting out for New Zealand.

It would be incorrect to state that there is no manufacturing carried on in this country in connection with electrical engineering, but the amount carried on is very small, and there are remarkably few openings here for elctrical engineers conversant solely with the manufacturing side. Indeed, this country has not yet reached the stage at which there is a demand for specialists in this line—or in most other lines—and the new arrival in this country must be prepared to take anything that is offered; unfortunately there is exceptionally little offered in any line at present.

In addition to the above, however, it cannot be too widely known that, although wages are somewhat higher here when a man is fortunate enough to be working, the cost of living is about twice as high as in England, while house rents in our towns—comparing our towns with towns of equal size in England—are three to four times as high as those in England. The man who can earn a living in England at the present time will be ill-advised to set out for New Zealand, unless he is under engagement before starting; and the specialist who elects to emigrate to New Zealand at the present time, even if he has capital to enable him to start on his own account, is unlikely to find his way a smooth one.

Geo. Clarke,
Editor, *New Zealand Engineer.*

Auckland, N.Z., *October 20th*, 1930.

The Two-part Tariff.

The writer of this article in your issue of November 14th candidly states that he has dealt with the matter in a provocative manner, a clear indication that he does not really believe what he writes.

Might I refer to his concluding paragraph wherein he states that the "most equitable tariff is that which renders all consumers equally satisfied," and add that it is the present multiplicity of tariffs which is responsible more than anything else for much of the dissatisfaction which does exist; Mr. Porter in his article is proposing yet another method of charging. Heaven preserve us from tariff makers!

Mr. Porter argues against the Committee's recommendation by saying that "obviously, the size of house will have no direct effect," and then argues in favour of the rateable value basis because the "assessment depends on (*a*) size of house," and therefore "it is equivalent to the size of house basis recommended by the Committee." He also gives as another reason in support of the rateable value basis that it "is so extensively used." The extent of its use is that less than 100 undertakings out of over 500 have adopted it, but many of them have had to juggle with the rateable value in order that it shall fit their

various conditions, clear evidence of the unreliability of rateable value as a uniform method.

Then Mr. Porter states that "equity insists that each consumer shall pay his correct share of both parts of the cost of supply," and then later on proceeds to argue that "if ability to pay is taken into account in industrial tariffs, there can be no objection to it in the case of domestic consumers." Having involved himself in "the proportionality" of the "consumer's peak responsibility" and started off with the high-brow of "equity" he finishes up with the low-brow of "vulgar commerce." Nero fiddled whilst Rome was burning, and we are fiddling with tariffs whilst gas is burning.

One other correction to Mr. Porter's article: the block or step method which the Committee summarily dismissed was not his tariff, which he also appears to label a "block or step" method. I think it a delightfully appropriate title because such tariffs do block any step in the progress of electricity supply.

Fredk. W. Purse.

London, S.W.1, *November 17th*, 1930.

I am glad that Mr. Ernest G. Pink's statement of *facts* is so unequivocal that I am relieved of all necessity of dealing with it. He admits that his views are not accepted by the majority, but that is hardly surprising in the light of his statement that the proportion of plant installed to apparatus connected has no connection with the consumer.

G. L. Porter.

Hollinwood, *November 21st*, 1930.

The E.D.A. Directorship.

When the post of Director and Secretary of the E.D.A. was advertised in the electrical papers, a closing date in October was given for the receipt of applications.

Since the original closing date I notice that the job has been advertised weekly—without any mention of a closing date—in one of your contemporaries. From this it would appear that the first advertisement failed to attract the right type of man. If this assumption is correct, the E.D.A. should now give fuller details of its requirements, and should publish them in all suitable journals, not in one only.

Incidentally, it is surprising that a position calling more for publicity and propagandist training than for electrical engineering qualifications, however high, should not also have been advertised in papers outside the purely electrical field.

Publicitas.

London, *November 21st*, 1930.

[We believe that this is due to an error on the part of our contemporary, which failed to discontinue the advertisement. We also understand that the position was advertised in one or more of the leading dailies.—EDS. ELEC. REV.]

Public Lighting.

I was very interested to see the list of districts* which are lighted entirely by electricity, nearly all of which can justly claim to have well-lighted streets.

There are of course any number of other places which use both gas and electricity, usually indicating the advantage of the latter; yet only a few Councils have appreciated the fact, and I do not think that any of the illumination experts have tried to educate them up to the modern methods of public lighting, which often appears to be a matter of accepting the lowest estimate submitted by the local gas and electricity companies.

What, however, does much harm to the cause is the inadequate lighting of certain main roads by electricity. One of the most glaring examples of this is part of the Edgware Road from Hendon to Edgware, where 60- or 100-watt lamps at 80 yards intervals are apparently considered sufficient for a road of this width, used by hundreds of motorists and others. Surely it is time this was brought to the notice of the offending Council, even if only for the safety of the general public in a growing district like this. London's main thoroughfare deserves a better fate.

H.C.G.

November 18th, 1930.

[* Issues of November 7th, 14th, and 21st.—EDS. ELEC. REV.]

Rural Electrification.

In connection with my article which you published on July 25th last, it may perhaps interest you to hear that I have carried out the electrification of one of my farms with considerable success. The matter has brought to my notice the absolute necessity for all motors installed to be built with mica and tropical insulation, as the ordinary home-type insulation is not good enough and only leads rapidly to possible trouble with low insulation resistance.

I am also arranging for a question to be asked in the House of Common regarding the amendment I advise to the Agricultural Holdings Act, which I dealt with in my article.

H. C. Wollaston, J.P., B.A.

London, S.W.5, *November 20th*, 1930.

Tariffs for Consulting Rooms.

It is disappointing to find that some progressive electricity supply authorities which are offering really attractive "all-in" domestic tariffs to private householders withhold these tariffs from doctors, dentists, and suchlike, with consulting rooms at their own homes, on the ground that a professional house of this nature is not a private residence.

Consumers of this class are amongst those best able to appreciate the advantages of electricity in the home, and it seems contrary to the best interests of domestic electrical development that tariffs designed to encourage it should not be made available to them.

It may be argued that the load due to the professional quarters of the house does not conform to the characteristics which make the special domestic tariff economically practicable in the case of the ordinary private household. To meet this objection it would surely not be difficult to apply to the tariff some simple modifying factor which would make it unnecessary to deprive this large and attractive class of consumer of all real incentive to use electricity extensively.

Possibly it is not in many places that this question arises, but it would certainly be interesting to have the comments of electricity supply engineers upon it.

R. J. Hebbert.

Hollinwood, *November 26th*, 1930.

Lt.-Col. Vignoles's Tour: What a Canadian Thinks.

Mr. Osborne Mitchell's letter in your current issue gives me an opportunity of amplifying (and explaining) the report of a short speech of mine that I thought of insufficient importance to trouble you about.

I was the culprit who used the word "gullible," but at the meeting I hesitated and tried to find the right word ("receptivity" was what I intended) and explained that I used "gullibility," not in an offensive sense, but as the nearest I could think of at the moment.

My point was that the qualities that made Britons seek new worlds to conquer caused them and their descendants to be more receptive to new ideas and that our slower progress here was not necessarily due to poor salesmanship, but to a great extent to poor "buymanship"—if I may coin a new word—also. Col. Vignoles understood my point, and so kindly refrained from shooting.

Of course, we are really doing a lot more over here than our overseas friends sometimes give us credit for. Mr. Mitchell is rightly proud of the way Canadians consume electricity, but I must try and score for England. My consumption for the past 12 months (four in family) was 30,828 kWh. Can he find a domestic consumer to beat that in Toronto? I was mentioning this to a friend from Newcastle way recently and he told me his consumption was 50,000 kWh.

Ernest E. Sharp.

London, S.W.12, *November 22nd*, 1930.

British Motor Prices.

Your correspondent "Sales Engineer" complains that our comparison of the cost of a gas or oil engine with the cost of an electric motor was rather unfair to the makers of the former. We plead guilty to having mentioned rather an extreme case, in order the better "to point a moral and adorn a tale."

Our suggestion that electric motor manufacturers, in framing their selling prices, should take into consideration the cost of competitive prime movers, as well as their own production costs, is not so "stupid" as your correspondent seems to think. The superiority of electric motors over their competitors, apart from the question of price, does not require stressing in the columns of this journal, and that the makers, holding all the trump cards in their hands, should indulge in the present orgy of price cutting is where the real stupidity comes in.

Who is the gainer? The user obtains a motor at a price far lower than he would be quite willing to pay, having regard to the cost of competitive prime movers and the advantages of the electric drive. As a matter of fact, the capital cost of electric motors, even when a reasonable price is charged, is usually a mere bagatelle compared with the cost of the other plant installed in a factory. On the other hand, the small manufacturers of motors are struggling to keep out of the Bankruptcy Court, while the large concerns are hiding the losses incurred in their small motor departments, in the profits made out of the central-station and other heavy plant. Through this price cutting a good many of the machines now turned out are a disgrace to British electrical engineering. To see, as we have done, a 5-h.p. motor sitting on slide rails made of stamped sheet steel is enough to make an engineer's hair stand on end.

Let the motor manufacturers give up this "Meccano" business and turn out an engineering job which will give satisfaction to themselves and the users, and at the same time yield a fair profit both to the makers and the contractors who handle their machines.

E. P. Allam & Co., Ltd.

London, W.C.1, *November 24th*, 1930.

The Coming Generation.

Your correspondent "Tauphi" in last week's issue of the REVIEW makes statements which should not be allowed to pass without reply. In the first place, he has misunderstood the report of Mr. H. T. Young's address to the London Students' Section of the I.E.E. There was no suggestion in that address that the young engineer of to-day was inferior to that of the pre-war generation, because no comparison of any kind was made. The address suggested that he was not always taking the fullest advantage of the commercial development of electricity to-day, particularly in the neglect of specialised methods of salesmanship. It is not the object of this letter to discuss the truth or otherwise of this, but rather to comment on your correspondent's remarks. He says that the young engineer of to-day prefers to get into some "cushy" job rather than to undergo the long years of practical workshop training which were considered essential in his day. He appears to be judging the requirements of to-day by the standards of his own generation, overlooking the fact that conditions have considerably changed. In the earlier days of the electrical industry when practical experience constituted the greater part of the engineer's attainments, such a system of training had obvious advantages. With the recent advances in theoretical knowledge derived from research and the intense specialisation in different branches of the industry, such a course is frequently a waste of time, which is better spent on a sound theoretical training and a limited amount of workshop experience when this seems desirable. Your correspondent does not appear to understand this new system of training, and accordingly condemns it. The sentence concerning the filling of posts seems hazy and ill-considered, and further it reflects very unfavourably on the pre-war generation of which "Tauphi" is one, since its representatives usually control the filling of posts by the younger generation.

It is not right to condemn the present generation of engineers for the employment of modern "labour-saving" methods of training in place of crude old-fashioned methods, as it is only by the employment of these that he is able to keep pace with the increased range of knowledge required to-day and to make the fullest use of the commercial developments in electricity.

L. S. Crutch.

London, S.E.22, *November 24th*, 1930.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged and all subsequent proceedings will be taken.

1929.

13,287. "Electric accumulators." Soc. Anon. des Accumulateurs Monoplaque." February 5th, 1929. (337,375.)

16,398. "Electrical distant indicating apparatus." Schneider et Cie. July 10th, 1928. (Addition to 245,761.) (315,261.)

18,815. "Submarine cable signalling systems." Standard Telephones and Cables, Ltd., and A. D. Blumlein. June 19th, 1929. (337,134.)

18,874. "Regulating transformers working in parallel." Siemens-Schuckertwerke Akt. Ges. June 22nd, 1928. (314,082.)

19,365. "Electric cables." P. H. Chase. July 25th, 1928. (Addition to 316,217.) (316,218.)

19,892. "Electric light signs." P. Hartung. June 28th, 1929. (Convention date not granted.) (337,378.)

22,870. "Furnaces employing combustion heating and electric heating in combination." International General Electric Co., Inc. July 25th, 1928. (316,229.)

23,152. "Driving sound films in sound recording and reproducing apparatus." British Thomson-Houston Co., Ltd. July 27th, 1928. (316,320.)

23,209. "Electric fuses." C. W. Cox. July 29th, 1929. (337,386.)

23,232. "Collecting electrode for electrostatic precipitators." National Carbon Co., Inc. November 14th, 1928. (337,389.)

23,257. "Telephone systems." Siemens Bros. & Co., Ltd., D. A. Christian, and A. T. C. Moore. July 29th, 1929. (337,393)

23,276. "Apparatus for transmitting orders, signals, or the like, between one position and another electrically." Chadburn's (Ship) Telegraph Co., Ltd., and A. C. Bamford. July 29th, 1929. (337,396.)

23,304. "Train control systems." Associated Telephone & Telegraph Co. August 1st, 1928. (316,617.)

23,517. "Electric cable systems for coastal navigation." Soc. Industrielle des Procédés W. A. Loth. August 1st, 1928. (316,624.)

23,568. "Automatic switches for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd., and H. Jackson. July 31st, 1929. (337,423.)

23,569. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., C. Gillings, and T. G. Rice. July 31st, 1929. (337,424.)

23,652. "Electric water-heating systems." A. J. Newman. August 1st, 1929. (337,450.)

23,674. "Electrical machines." T. J. Nilsson-Stig. August 16th, 1928. (317,444.)

23,702. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and R. Taylor. August 1st, 1929. (337,453.)

23,770. "Electron-discharge devices." British Thomson-Houston Co., Ltd. August 2nd, 1928. (316,678.)

23,871. "Electrically controlled variable-speed gear." W. Casson and H. Roberts. August 3rd, 1929. (337,464.)

23,916. "Wireless and visual systems for use in navigation." Graham Amplion, Ltd., W. J. Rickets, and D. Sinclair. August 3rd, 1929. (337,469.)

23,928. "Sound film and apparatus for reproducing thereon." Selenophon Lich-und Tonbildges. March 27th, 1929. (337,472.)

24,043. "Electromagnetic relays." Automatic Telephone Manufacturing Co., Ltd., H. S. Woodhead, and J. McGavin. August 6th, 1929. (337,476.)

24,294. "Installations for the irradiation of substances with ultra-violet light." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 8th, 1928. (318,616.)

24,535. "Electrical process and apparatus therefor." Soc. de Prospection Electrique (Procédés Schlumberger). October 26th, 1928. (337,489.)

24,622. "Sealing or joining of metal objects to insulating material." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). August 12th, 1929. (337,491.)

24,920. "Variable electric impedances." C. H. Smith. August 15th, 1929. (337,494.)

25,204. "Electromagnetic movements for telephonic loud speakers, telephone receivers, and the like." H. C. H. Smyth. August 19th, 1929. (337,499.)

25,273. "Speed-controlling devices." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). August 19th, 1929. (337,500.)

25,636. "Actuating mechanism for electrical switches." S. Ruppel. August 22nd, 1929. (337,508.)

26,036. "Automatic telephone systems." Siemens Bros. & Co., Ltd., D. A. Christian, and W. G. Patterson. August 27th, 1929. (337,513)

26,174. "Automatic telephone systems." Siemens Bros. & Co., Ltd., W. G. Patterson, and D. A. Christian. August 28th, 1929. (337,515)

27,268. "Seals for containers of electrical discharge apparatus or the like." General Electric Co., Ltd., and E. Gallizia. September 7th, 1929. (337,527.)

28,936. "Volume-control apparatus for combined phonographs and radio receivers." British Thomson-Houston Co., Ltd September 26th, 1928. (319,695.)

29,509. "Electric cables." P. H. Chase. October 20th, 1928. (337,541.)

29,995. "Telephone systems." P. Del Gaizo and G. Gianolio. October 4th, 1928. (337,548.)

30,025 "Wander plugs and like electrical connectors." E. M. Taunton. October 3rd, 1929. (337,549.)

30,174. "Cap-mounting devices for carbon electrodes." H. Blanche. March 28th, 1929. (337,550.)

30,176. "Casings for wireless and other apparatus." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabricken). October 4th, 1929. (337,551.)

30,191. "Electrically-driven mechanism for operating, indicating, recording, and other relay apparatus." Cambridge Instrument Co., Ltd., and W. J. Stallan. October 4th, 1929. (337,552.)

30,529. "Arrangement of telephone apparatus." Telefonaktiebolaget L.M. Ericsson. October 12th, 1928. (337,556.)

30,729. "Electric power-station systems having automatic voltage regulations." Allmanna Svenska Elektriska Aktiebolaget. October 13th, 1928. (337,561.)

31,140. "Electric power-station systems having automatic voltage regulations." Allmanna Svenska Elektriska Aktiebolaget. October 15th, 1928. (337,575.)

31,285. "Electric switchgear." General Electric Co., Ltd., and C. C. Garrard. October 15th, 1929. (337,576.)

31,340. "Electric heating elements." C. Sykes, R. G. Alger, and Associated Electrical Industries, Ltd. October 15th, 1929. (337,578.)

32,416. "Electrodes or rods for welding." J. H. Aitchison, H. Bull and L. Johnson. October 25th, 1929. (337,589.)

32,561. "Electrical resistances." J. Y. Walsh. October 26th, 1929. (337,591.)

32,936. "Magnetos." M-L Magneto Syndicate, Ltd., and E. A. Watson. October 30th, 1929. (337,596.)

33,076. "Insulating cover for live rail in electrified areas." Dunlop Rubber Co., Ltd., P. E. Lavell, and J. R. Ward. October 31st, 1929. (337,598.)

34,973. "Micro-telephones." Mix & Genest Akt. Ges. November 16th, 1928. (337,615.)

35,894. "Cooling of electric current transformers." J. T. Rothwell & Co., Ltd., and G. Yates. November 23rd, 1929 (337,629.)

36,627. "Apparatus for use in the electrical precipitation of solid or liquid particles from gases." Lodge-Cottrell, Ltd., and L. Lodge. November 24th, 1929. (337,642.)

38,035. "Contactor starters for electric motors." Electrical Apparatus Co., Ltd., R. H. Barbour, and J. R. Walton. December 11th, 1929. (337,658.)

38,567. "Electric cables." Siemens Schuckertwerke Akt. Ges. December 20th, 1928. (337,663.)

1930.

971. "Electric lighting circuits chiefly for kinematographic screen projection apparatus and the like." Pathé Cinema, Anciens Etablissements Pathé Frères. February 8th, 1929. (337,681.)

1,378. "Apparatus for electrical precipitation of suspended material from gases." Lodge-Cottrell, Ltd. (International Precipitation Co., Inc.). January 14th, 1930. (337,685.)

2,267. "Graphite electrodes suitable for use in selenium cells." Telefunken Ges. für Drahtlose Telegraphie. February 13th, 1929. (337,691.)

3,405. "Talking motion-picture apparatus using photographic sound-records." British Talking Pictures, Ltd. August 24th, 1929. (337,697.)

4,594. "Alternating current generator with modulation frequency." W. Dornig. February 14th, 1929. (337,699.)

5,146. "Electron discharge devices." Westinghouse Lamp Co. February 16th, 1929. (337,704.)

5,436. "Synchronous operation of electric motors." British Consolidated Investments Corporation, Ltd. (C. M. Ebeling). February 18th, 1930. (337,321.)

5,705. "Anchor-socket especially for fastening current carrying-apparatus to switchboards." G. Hess. March 11th, 1929. (337,705.)

11,560. "Electric motor control systems." Associated Electrical Industries, Ltd. April 11th, 1929. (337,719.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections agannst any of the proposed marks may be entered within one month from November 19th :—

Arcturus. No. 513,601. Class 8. Radio detecting, rectifying, and amplifying tubes, photo-electric cells, X-ray tubes, and thermionic relays.—Arcturus Radio Tube Co., Newark, N.J., U.S.A. (British representatives: Marks and Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Panc. No. 515,685. Class 8. Electric current transformers.—J. G. Statter and Co., 16, Great George Street, S.W.1.

Rayette (lettering and design). No. 516,446. Class 8. Radio-telephonic apparatus and parts thereof.—L. S. Weisman, 128, King Street, Hammersmith, W.6.

Imperic. No. 516,668. Class 8. Radio receiving sets, gramophones in combination with radio receiving sets, and parts of such goods.—Majestic Electric Co., Ltd., Tariff Road, Tottenham, N.17.

O.R.L., Overseas Five (lettering and design). No. 516,783. Class 8. Radio-telephonic apparatus and parts thereof.—Overseas Receivers, Ltd., 18, Ganton Street, Regent Street, W.1.

Rotalix. No. 515,207. Class 11. Instruments, apparatus and contrivances for surgical and curative purposes.—Naamlooze Vennootschap Philips Gloeilampenfabrieken, Holland. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Jiffilinx. No. 511,221. Class 13. Wire connections for use in radio-telephonic and telegraphic apparatus.—R. R., Ltd., 159, Borough High Street, S.E.1.

Pearlexa. No. 513,889. Class 13. Electric lamps (ordinary).—British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.

Siluminite. No. 515,498. Class 16. Electrical insulators and insulating material of porcelain or earthenware. No. 515,499. Class 50. Electrical insulating material.—Turner's Asbestos Cement Co., Ltd., Trafford Park, Manchester.

Mipor. No. 516,724. Class 40. Goods manufactured from india-rubber and gutta-percha.—Britannia Batteries, Ltd., 233, Shaftesbury Avenue, W.C.2.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALFORD.—Schools for Lindsey E.C.; H. G. Gamble, architect, Bank Street Chambers, Lincoln.

ARDROSSAN.—Academy, with electrical work, for Ayrshire C.C.; W. Reid, architect, Ayr.

AYRSHIRE.—Theatre, Saltcoats (1,400 seats); H. Kemp.

BIRCHINGTON (Kent).—Bank, Station Road; Westminster Bank, Ltd.

BLACKBURN.—School; Rev. D. L. Jones, vicar of St. Francis' Church.

CAMBRIDGE.—Extensions, Girton College (£75,000); Miss S. Campbell, organising secretary, 2, Brick Court, Temple, E.C.

CATERHAM.—Bank, High Street; Lloyds Bank, Ltd.

CHAILEY.—Colony for mentally defectives for East Sussex C.C. (£60,000); clerk, Lewes.

CLYDEBANK.—Houses (192) for Town Council (£56,300); burgh surveyor.

DARENTH.—Housing scheme, Lanes End; Dartford R.D.C. surveyor.

DARTFORD.—Nurses' home, poor law institution (£15,000); G. E. Burgess, architect.

DARWEN.—Re-erection of Vale Street Mill for John E. Berry, 41, St. Albans Road (£30,000).

DONCASTER.—Houses (292); R. E. Ford, housing surveyor, 3, Priory Place.

DUMFRIES.—Cinema theatre; John Darlison, The Playhouse.

DURHAM.—Schools, Hurworth and Stockton-on-Tees, for the county E.C.

EASINGTON (Co. Durham).—Houses (200) for the R.D.C.; surveyor.

ESSEX.—New schools, Ardleigh Green and Chadwell Heath, and enlargement of Grammar School, Maldon (£10,000); county architect.

GLASGOW.—Schools, Balmore Road (£60,000), Buckley Street (£23,000), and Pollokshaws Road (£80,000), for the E.C.; master of works, Education Offices, Bath Street. R.C. church, Boyd Street and School Street; rector.

GODALMING.—Cinema, Ockford Road; County Cinemas, Ltd.

HANTS.—School (360 places), Hedge End, for the county E.C.; director of education, Winchester.

HERTFORD.—Re-erection of portion of Ponsbourne Park Mansion, residence of Sir Hildred Carlisle, Bart.

HULL.—Malet Lambert School (£67,745) for the E.C.

KINGSTON-ON-THAMES.—Houses (117), Malden, for the T.C.; borough surveyor.

KINGSWINFORD.—Houses (56) for the R.D.C.; Eadie, Towers & Co., builders, Wolverhampton.

LANCASHIRE.—School, Grange-over-Sands, for the county E.C.; director of education.

LEEDS.—Junior and infants' school, Potternewton Lane; architect's section, Education Department, Calverley Street.

LINCOLN.—Hospital, Bracebridge (£86,000); Holland (Lincs.) C.C.

LONDON (Shoreditch, E.).—Bank, 311, New North Road; Westminster Bank, Ltd.

(Barnes, S.W.).—Houses, baths, and wash-houses (£13,650) for the U.D.C.; W. Lowe & Son, Ltd., builders.

LONDON—*continued.*

(Clapham, S.W.).—Factory extensions, South Side, Clapham Common; W. G. Gage & Sons, Ltd.

(Streatham, S.W.).—Extensions, Cow's Rubber Factory, Factory Square; Bleach & Dorey, Ltd.

(Tooting, S.W.).—Flats (51), Fountain Road (£32,183); E. Clarke & Sons. Flats (58), Garratt Lane; R. Mountford Piggott, architect. Cinema, Mitcham Road; C. Massey, architect.

LOWESTOFT.—Clinic, Lowestoft and North Suffolk Hospital; East Suffolk county architect.

MAIDSTONE.—Wesleyan church, Eccleston; trustees.

MERTON (Surrey).—Schools (704 places) St. Helier estate, for the Roman Catholic managers; priest-in-charge.

PADIHAM.—Houses (100) for the U.D.C.; surveyor.

PAIGNTON.—Additions, Montpelier School, Upper Manor Road; T. L. Green.

PURLEY.—Four shops and flats, Godstone Road; J. P. Oldaker.

RADCLIFFE (Lancs.).—Labour exchange for H.M. Office of Works, King Charles Street, London, S.W.

RAMSGATE.—Wesleyan church, Northwood; trustees.

RISHTON.—Senior school; director of education, County Offices, Preston.

ROWLEY REGIS.—Offices and works, railway station; Great Western Railway Co.

ST. ALBANS.—Re-erection of printing works for Fisher, Knight & Co., King's Road.

SALFORD.—Masonic hall, with electrical and heating work; Fearnley, Ltd., builders, Eccles New Road.

SPALDING.—Offices, Exchange Arcade, for the U.D.C.; A. E. Palmer, architect, 1a, Pinchbeck Road.

SUNDERLAND.—Concert hall, kinema, &c., Roker; borough engineer.

SURREY.—Secondary school, Tollers Lane, Coulsdon, for the county E.C. Central school, Walton-on-Thames (£10,530); Soole & Son, builders.

SWADLINCOTE.—Houses (99), Upper Midway, for the U.D.C.; Baines, Provis & Cope, 22, Friar Lane, Leicester.

THORNBURY (Glos.).—Houses (83) for the R.D.C.; surveyor.

TUNBRIDGE WELLS.—Cinema, Mount Pleasant; W. J. King, architect.

WAKEFIELD.—Alterations, Belle Vue Picture House; Dobson & Gighall. Maternity hospital, &c., Manygates Park (£15,000); city architect.

WARE.—Extensive additions, Haileybury College; principal.

WARRINGTON.—Houses (122) for the T.C.; borough surveyor.

WARWICKSHIRE.—Two schools, Kenilworth, for the county E.C.; director of education, Leamington Spa. Extensions, Ensor school, Baddesley (£13,750), and high school, Rugby (£29,000); county architect.

WEST RIDING.—Schools, Rothwell and Honley, and extensions, Pontefract, Keighley, Skipton, Hemsworth, Knaresborough, Woodhouse, and Heckmondwike, for the county E.C.; education architect, Wakefield.

WHISTON (Lancs.).—Houses (118), Howson Road, for T. Ward.

WIGAN.—New senior schools (640 places), Frog Lane, for All Saints' C. of E. managers; Grayson & Barnish, architects, 58, Rodney Street, Liverpool.

WORCESTER.—Houses (214), Barnshall site, for the T.C.; city surveyor.

WORCESTERSHIRE. — Schools, Bromsgrove, Causeway Green, Lye, and Stourbridge, for the county E.C.